JPRS 75543

22 April 1980

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

No. 51

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

No. 51

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CONFERENCES

CRYSTAL FOR DISPLAY TERMINAL

Moscow TEKHNIKA I NAUKA in Russian No 11, 1979 p 13

[Article by unnamed author]

[Text] Designers and users of computers have, on the whole, been satisfied with the parameters of modern calculating machines. The situation becomes more complicated when we are talking about data storage media. A peerless memory was proposed by specialists at the Institute of Physics of the Estonian Academy of Sciences. A skiatron-type CRT was designed which uses the local coloration effect of crystalline materials--synthetic halide sodalites--by the electron beam. Cathodochromic CRTs have unique properties compared to other displays. Here the image on the screen is contrastive, clear and stable. In consequence, the device can be used under conditions where ordinary light-emitting devices are virtually useless. Since the crystal substance of the skiatron is at the same time a display and a memory, the new CRT does not require large memory units and data storage per se is accomplished without energy consumption. The image is erased from the sodalite screen of the display (it can be up to one square meter in area) by an excess of heat or by the electron beam. The new CRT is expected to be used not only for computers, but also for introscopes, radar, phototelegraphs and display panels.

[149-8617]

8617
CSO:1863

HOW CAN INTEGRATED CIRCUITS BE REMOVED?

Moscow TEKHNIKA I NAUKA in Russian No 11, 1979 p 15

[Article by unnamed author]

[Text] This is not a simple problem. You not only have to keep the PCB intact, but you also do not want to alter the electrical characteristics of the circuit.

An effective thermomechanical method for removing "extra" components was recently proposed by Muscovite engineers which is based on thermal decomposition of polymers. The new technological process consists of two sequential operations. The first step is to unsolder the leads of the IC. The connection point is heated until the solder softens. Then the lead is carefully elevated 0.5-1 millimeter. Next comes disassembly--a most demanding procedure. A simple appliance like a bronze soldering tip was specially developed for attachment to the soldering iron. The temperature of the tip must not exceed 130°. This is quite enough to easily remove an IC from the PCB. It was also verified that such heating does not affect the electrical characteristics of the circuit. The address for requests for documentation is: 125493, Moscow, A-493, Poisk Central Scientific-Technical Institute.

[149-8617]

8617
CSO: 1863

USSR UDC 681.327.2.082.5

OPTOELECTRONIC SEMIPERMANENT COMPUTER STORAGE UNIT WITH FIBER-OPTICS SPLITTING OF LUMINOUS FLUX

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, 1979 pp 31-32

CHAGULOV, V. S., CHAYKOVSKIY, L. P. and VRUBLEVSKIY, L. L.

[Abstract] An optoelectronic semipermanent storage unit (OSSU) based on a fiber-optics system with partial interaction of the matrix elements of emitters and photoreceivers--each light-emitting diode (LEM) is optically connected to part of the receiving-matrix photodiode (PD)--is described. The fiber-optics system consists of polymeric optical waveguides of 0.2 mm diameter whose ends are bunched and connected to the LEM. The OSSU has a capacity of 10^4 bits, and the readout cycle time per 100-bit word is 0.3 microsec. This time can be further shortened by using faster-acting LEM and PD. Although such fiber-optics OSSU with partial matrix interaction are inferior to devices in which each LEM is optically connected to the entire PD matrix, the efficiency of utilization of their active optoelectronic elements is such that they can find application for the storage of smaller programs in the development of process control systems and monitoring and metrological equipment. Figures 2; references 7 Russian.
[154-1386]

USSR UDC 658.589.011.46"313"

INTEGRATION OF FUNCTIONS AS THE FUTURE OF AUTOMATIC PROCESS CONTROL SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, 1979 pp 2-4

LEVIN, A. A., Deputy Chief, VO Soyuzpromavtomatika [All-Union Industrial Automation Association]

[Abstract] In recent years two new approaches have arisen in industrial automation theory and practice: the first pertains to the use of an identifier in the feedback circuit of adaptive automatic control systems (formation of a mathematical model of the technological process), while the second, to the extension of automated control to the automation of the primary information gathering operations with the object of obtaining the data needed for active control of industrial processes. In the second case the development of on-line sensors is a major technical problem. The efficiency of automated control systems can be maximized if both these approaches are

combined. This is because, on the one hand, the use of an identifier (i.e. of a special learning program along with refinements of the model on the basis of real data) optimizes the utilization of momentary data on a process, while, on the other, sensor monitoring serves to obtain data of an accuracy whose extent should depend not only on the tasks but also on the possibilities for model identification and the triggering of control actions. It is to be expected that such an integration of both approaches will optimize the solution of the problem of enhancing the efficiency of present-day and future control systems. Figures 6.
[154-1386]

ARRAY REPRESENTATION OF A SYSTEM OF SWITCHING FUNCTIONS

Moscow IZVESTIYA VUZ PRIBOROCTROYENIYE in Russian No 10, 1979, pp 54-56

[Text of article by M. A. Gladsteyn, Rybin Aviation Technological Institute]

[Text] A matrix method for representing a system of switching functions is proposed.

Multioutput combinative circuits (code converters) occupy a significant place in digital computing devices. Such circuits are used for the direct conversion of one code into another in output chains and inverse connections of finite automata with memory, and as a constant memory store. Code converters are described by a system of m switching functions of n arguments. The latter, as a rule, are specified by means of a table.

For the purposes of automated design of digital computing devices great interest attaches to how to go formally from the tabular method of specifying a system of switching functions to their analytic representation in one of the completely normal forms. In this work it is demonstrated that this can be accomplished with the help of a matrix representation of the system of switching functions.

Let there be a system of m switching functions of n arguments specified in a completely disjunctive normal form:

$$\begin{aligned} f_0^n &= a_{00}k_0^n \vee a_{01}k_1^n \vee a_{02}k_2^n \vee \ldots \vee a_{0N}k_N^n, \\ f_1^n &= a_{10}k_0^n \vee a_{11}k_1^n \vee a_{12}k_2^n \vee \ldots \vee a_{1N}k_N^n, \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ f_{m-1}^n &= a_{(m-1)0}k_0^n \vee a_{(m-1)1}k_1^n \vee \ldots \vee a_{(m-1)N}k_N^n, \end{aligned} \qquad (1)$$

where f_i^n are the switching functions of n arguments; $i \in 1$, $1=(0, m-1)$; k_j^n is the unity constituent, equal to unity for the jth set of arguments; aij is the value of the function f_I^n for the jth set of arguments; $aij \in \{0,1\}$, $j \in J$, $J=(0,N)$, $N=2^n-1$.

System (1) is easily represented in a matrix form (here and further the signs of the operations on the Boolean matrices are as in [1]).

$$F = M \otimes K, \qquad (2)$$

where
где $F = \left\| \begin{matrix} f_0^n \\ f_1^n \\ \vdots \\ f_{m-1}^n \end{matrix} \right\|$ — is the matrix-column of switching functions of size m,

$M = \left\| \begin{matrix} a_{00}a_{01}a_{02}\cdots & a_{0N} \\ a_{10}a_{11}a_{12}\cdots & a_{1N} \\ \cdots\cdots\cdots & \\ a_{(m-1)0}a_{(m-1)1}\ldots & a_{(m-1)N} \end{matrix} \right\|$ — is the matrix of values of switching functions of size m X 2^n,

$K = \left\| \begin{matrix} k_0^n \\ k_1^n \\ \vdots \\ k_N^n \end{matrix} \right\|$ — is the matrix column of the unity constituents of n arguments of size 2^n.

Matrix M in (2) is a summary table of the values of the system of switching functions, with the lines of this matrix corresponding to the functions, and the columns to the sets, as is customary [2,3].

The matrix column of the unity constituents can be represented in the form:

$$K = \| D\bar{D} \| \circ \left\| \begin{matrix} \bar{X} \\ X \end{matrix} \right\|, \qquad (3)$$

where / где $D = \left\| \begin{matrix} 000\ldots0 \\ 000\ldots1 \\ \ldots\ldots \\ 111\ldots1 \end{matrix} \right\|$ — is the matrix of sets of size $2^n \times n$,

$X = \left\| \begin{matrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{matrix} \right\|$ — is the matrix-column of arguments of size n.

Substituting (3) in (2), we obtain

$$F = M \otimes \| D\bar{D} \| \circ \left\| \begin{matrix} \bar{X} \\ X \end{matrix} \right\|. \qquad (4)$$

The matrix relationship (4) makes it possible to formalize the transition from a tabular specification of the system of switching functions to a completely conjunctive normal form:

$$F = M \circ \| D\bar{D} \| \otimes \left\| \begin{matrix} \bar{X} \\ X \end{matrix} \right\|. \qquad (5)$$

The use of formulas (4) and (5) in the practical work of automated design of electronic computing automata makes it possible to lower the expenditure of machine time on the synthesis of logical circuits.

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Recommended by the Department of Radiotechnology. Received 20 June 1978.
[745:9285]

9285
CSO: 8144/745

UFIMKABEL' PLANT INCORPORATES NEW PRODUCTS

Moscow SOVETSKAYA ROSSIYA in Russian 6 Jan 80 p 2

[Article by Yu. Andreotti, Ufa: "For Electronic 'Nerves'"]

[Excerpt] The Ufimkabel' [Ufa Cable] Plant produces unique small-gauge wire for the circuitry of third-generation computers. Some of these wires are no larger than human hairs. Thanks to new technology these wires no longer need the traditional soldering connection. Instead they are connected by a special twist that leaves 24 reliable touching points at the place of contact. The connection is performed very quickly by a pistol-type device. Painstaking tests have indicated that the vibration resistance of assemblies is sharply improved by this technique. Moreover, the innovation conserves tin and raises labor productivity.

The plant has also begun production of ribbon wire for domestic pocket calculators.

One of the sections at the Ufimkabel' Plant produces braided self-coiling telephone cord, which is being used with every telephone receiver in the country. In one year the plant supplies about 2.5 million sets of this convenient device.

11,176
CSO: 1863

SIBERIAN INSTITUTE DEVELOPS 'KAMAK' GENERAL-USE AUTOMATED SYSTEM

Moscow IZVESTIYA in Russian 26 Jan 80 p 6

[Article by A. Illarionov, Novosibirsk: "Born in Siberia"]

[Text] The USSR State Committee for Standards has ratified the state standard, developed at the Siberian Department of the Academy of Sciences USSR, for the system of general-use automation equipment with the tentative name "KAMAK." The development, done at the Institute of Automation and Electrometry of the Siberian Department, resolved the problem of designing standard automated units for scientific institutions and helped consolidate laboratory automated research systems.

One more important application of KAMAK units is in putting together complex scientific instruments. Examples are the precision photogrammetric device called the "Zenit," the high-speed Planshet graph plotter, and a laser velocity gauge.

The experimental plant of the Siberian Department of the Academy of Sciences USSR is producing up to 50 types of KAMAK equipment for institutes. Specialists remark that it is as good as the best world models. The KAMAK system is Siberian by birth, but it has gone far beyond its native region. At the experimental plant of the Academy of Sciences USSR the Ratan-600 automated radiotelescope control system has been devised.

11,176
CSO: 1863

USSR UDC 681.326.7

CONSTRUCTION OF A COMPLETE PERFORMANCE TEST FOR n-BIT ADDERS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 11, 1979 pp 161-169 manuscript received 13 Dec 78

DUBOVA, T. A. and PEROV, V. V., Moscow

[Abstract] A method for constructing variants of a performance test for a n-adder consisting of standard bit modules is proposed. The method assures the detection of any combinations of persistent logic malfunctions. The test or experiment consists in producing a specific input effect on the adder, observing the output signals, and comparing the results with a standard, i.e., with the results of the performance of a correctly functioning adder. To this end, a test consisting of a minimum number of input effects and assuring the checking of n-bit adders for malfunctions of any multiplicity, is constructed. Test variants derived by this method are minimally complete for any combinations of logic malfunctions. Proof of the completeness and minimality of these test variants is presented. The construction of a representative test is described. The method is designed to cope with the increasing complexity of computer system components due to the development of integrated circuit technology. Figures 6; references 2 Russian. [167-1386]

UDC 658.512△62-52

DATA BASE AS THE BASIS FOR CONSTRUCTION AND IMPROVEMENT OF AN AUTOMATED SYSTEM FOR THE DESIGN OF TECHNOLOGICAL EQUIPMENT

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1979 pp 33-34

[Article by L. V. Gubich, engineer, and A. G. Rakovich, candidate of technical sciences]

[Extracts] In the Institute of Technical Cybernetics of the Belorussian Academy of Sciences and in other organizations a number of automated systems for the design (SAPR) of means of technological equipment have been developed, and they are being successfully used at many industrial enterprises of the country. The stage has now started in which a transition is needed from the creation of special-design automated design systems to the development and wide distribution of problem-oriented software, which must substantially accelerate and simplify the very process of SAPR construction by introducing elements of automation into it. In connection with this work has been expanded on determination of invariant SAPR components, the development of software to intensify the construction of design systems and the creation of packages of practical programs.

The investigation of questions of the structural organization of data, the development of a complex of programs for control of the data base and improvement of design systems on that basis are new steps on the path of development of the theory and methods of automating the designing of technological equipment which have been worked on in the Institute of Technical Cybernetics of the Belorussian Academy of Sciences for a number of years.

[173-2174]

2174
CSO: 1863

UDC △621.7.077△ 62-5

DIGITAL COMPUTER ANALYSIS OF MULTIFUNCTION LOGICAL ELEMENTS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1979 pp 34-36

[Article by M. V. Cherkashenko, engineer]

[Excerpts] In the construction of discrete control systems (see the article of the author in the No 12, 1978 issue of this journal) the task arises of analyzing the multifunction logical elements that realize a large number of different logical functions of n variables.

Analysis of multifunction logical elements (MLE) includes the following stages: calculation of the function realized on the MLE outlet; calculation of all the subfunctions obtained on the MLE outlet as a result of adjustment of its inputs (successive feeding to the MLE inputs of various combinations of signals from the set (0, 1, X), X is the input signals of the obtaining of various functions on the MLE outlet).

MLE analysis is a task that requires large expenditures of time. In the analysis of the logical capacity of several MLE's it is necessary to combine them with one another by various methods, to calculate the functions on the outlet of the last MLE, the quantity of which is equal to the quantity of methods of combination, and then calculate all the subfunctions realized on the outlet of the last MLE. Therefore it is advisable to analyze MLE by means of an electronic computer.

Let us examine the method developed at the VNIIgidroprivod [expansion unknown] on the example of analysis of two three-line pneumatic distributors.

The method of analysis is widely used in the VNIIgidroprivod in the creation of optimal discrete systems for the control of automatic machines.

[173-2174]

2174
CSO: 1863

USSR

ELEKTRONIKA BZ-21 PROGRAMMABLE CALCULATOR

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 11, 1980 pp 21-23

[Excerpts] The Elektronika BZ-21 has a 60-step programmable memory, 7 storage registers, a range from 10^{-99} to $\pm 9.999999 \times 10^{99}$, and a 12-digit display capable of showing imaginary numbers. The absence of inverse trigonometric functions, lowspeed and an operating time of less than two hours limit the calculator's suitability for geodetic work.

[153]
CSO: 1863-P

UDC 681.327.12

ALPHANUMERIC DISPLAY BLOCK

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979
manuscript received 16 Oct 78 pp 53-54

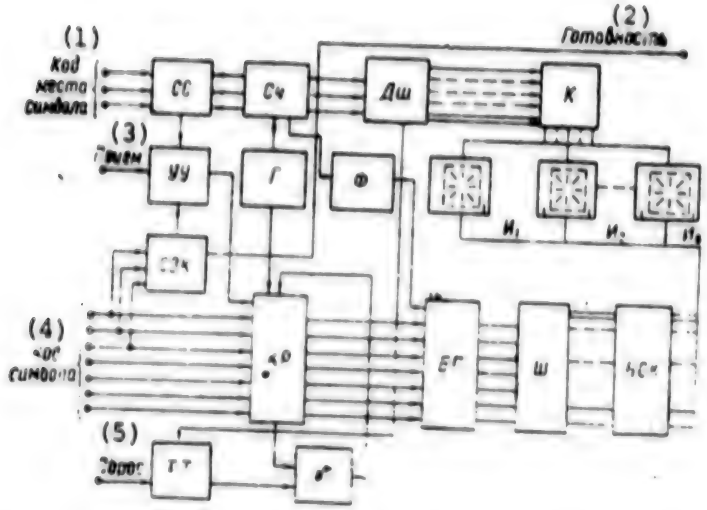
[Article by Engineers P. N. Gusachenko and V. M. Goncharenko]

[Text] A block for control of an alphanumeric device, constructed on 18-segment vacuum-luminescent displays of type IV-4 and IV-17 (see figure), was developed at the Severodonetsk branch of OKBA [Experimental design office for automation]. The considered diagram of the block is presented for the case of constructing and eight-digit display device operating in the sequential information input mode in each digit.

Unlike known circuits, the alphanumeric display block receives, converts and siplays either seven-bit symbol codes (GOST [State Standard] 13052-74) or eight-bit symbol codes (GOST 19768-74) and permits operation directly from the computer (for example, the M-6,000, SM-1 and SM-2).

The moment of recording the input information is determined when a combination of unit voltage levels in the three top digits of the symbol code arrives. The location of the recording is determined by the arrived symbol location code, which is compared in the comparison circuit SS to the current counter code Sch. If there are resolving signals from the SS and the Szk code recording circuit, the register control device UU forms a gate for recording information in the circular register KR. The signal "Receive" is intended to control the display board, consisting of display devices and operating from a single computer. The recorded information is stored in the KR and the symbol code whose storage location is determined by the counter code Sch is rerecorded periodically when the counter code Sch is replaced to the buffer store BP. Moreover, sequential selection of the displays of device $I_1,\ldots,I_8$ occurs periodically when the counter code Sch is changed and the dynamic method of information display is thus accomplished. The coder Sh converts the symbol codes stored in the buffer storage BP into an 18-digit code for control of the display segments.

A diode coder, programmable diode coder, programmable coder for limited set of letters and numbers (20-30) and a coder based on logic elements can



Block Diagram of Unit: G--generator; F--recording gate shaper; K--net keys; TT--information erasure flip-flop; BSK--segmental key block; Dsh--decoder

Key:

1. Symbol location code
2. Readiness
3. Reception
4. Symbol code
5. Dump

be used for similar display block circuits. However, a large number of circuit components is required to construct these coders, which is related to additional expenditures. The use of PZU based on integrated circuits for construction of the coder considerably simplifies its realization and permits synthesis of essentially the entire set of symbols of alphanumeric information. The "Readiness" signal is used to synchronize information input during operation of the circuit from a computer. The display devices made on the basis of 18-segment displays can be used in many cases instead of expensive display devices based on cathode-ray tubes.

The tests positively confirm the correctness of the technical solution.

The first experimental models have now been introduced at the Cherkassy PO [Production Association] Azot as part of the ASUTP [Automated production process control system] hardware of the ammonia unit.
[1863/159-6521]

6521
CSO: 1863

NEW COMPUTER DISK PACKS ANNOUNCED

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979 inside back cover

[Text] The VTO Izotimpeks offers YeS-5053, YeS-5261, YeS-5269 and IZOT-5266 disk packs, made according to modern technology, to computer users.

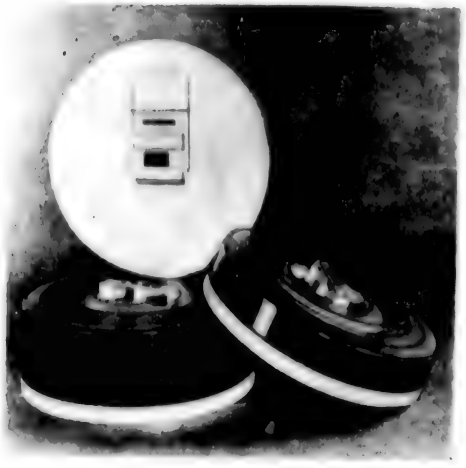
Main Specifications

Parameters	YeS-5053	YeS-5261	YeS-5269	IZOT-5266
Capacity, MB	7.25	29/58	2.45/5	100
Number of Disks	6	11	1	12
Number of Recording Surfaces	10	20	2	20
Track Density, TPI	100	100/200	100/200	200
Recording Density, BPI	1,000	2,200	2,200	4,400
Possible Compatibility with IBM or Equivalent (EV)	IBM 1311 or EV	IBM 2314 or EV	IBM 5440 or EV	IBM 3330 or EV
Specification	2,864	3,564	3,562	4,337

The exporter is VTO Izotimpeks, Sofia Bulgaria, ul. Chapayeva, 51, the telephone number is 73-61 and the Telex number is 022731.

The products of foreign companies can be acquired by organizations and enterprises in the established procedure through the ministries and agencies to which they are subordinate.

Requests for prospecti and catalogues should be sent to the address: 103074, Moscow, pl. Nogina, 2/5, Department of Industrial Catalogues of the State Scientific and Technical Library of the USSR. Refer to No 3707-9/103/124-34, V/O Vneshtorgreklama.
[1863/159-6521]



6521
CSO: 1863

THE ELKA 80 CASSETTE RECORDING APPARATUS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979 p OB

The Elka 80 cassette recording apparatus is intended for mass use in all spheres of commercial service. The apparatus carries out multiplication, readout and sets accumulator registers to zero, records check and test tapes and prints out the date and number of cash registers.

The Elka 80 includes three accumulator registers for commercial groups, an accumulator register for cancelled costs, four counters, two 6-digit display devices and a Seiko printer with printing speed of 1.5 rows/s.

Specifications

Operating Mode	Accumulating and service
Information Storage Time	Not more than one month
Computation of Account Number	Automatic
Overall Dimensions (together with case)	460 x 400 x 180 mm
Mass	19 kg

An audio signal is transmitted with a correctly performed operation.

The exporter is Isotimpex VTO Izotimpeks, Sofia Bulgaria, ul. Chapayeva, 51, the telephone number is 73-61 and the Telex number is 022731 and 022732.

The products of foreign companies can be acquired by organizations and enterprises within the established procedure through the ministries and agencies to which they are subordinate.

Requests for prospecti and catalogues should be sent to the address: 103074, Moscow, pl. Nogina, 2/5, the Department of Industrial Catalogues of the State Scientific and Technical Library of the USSR. Refer to No. 3707-9/103/k24034, V/O Vneshtorgreklama.
[1863/159-6521]

6521
CSO: 1863

UDC 621.3-523.8:65

COMPARATIVE ANALYSIS OF USING DATA BANKS IN ASUP

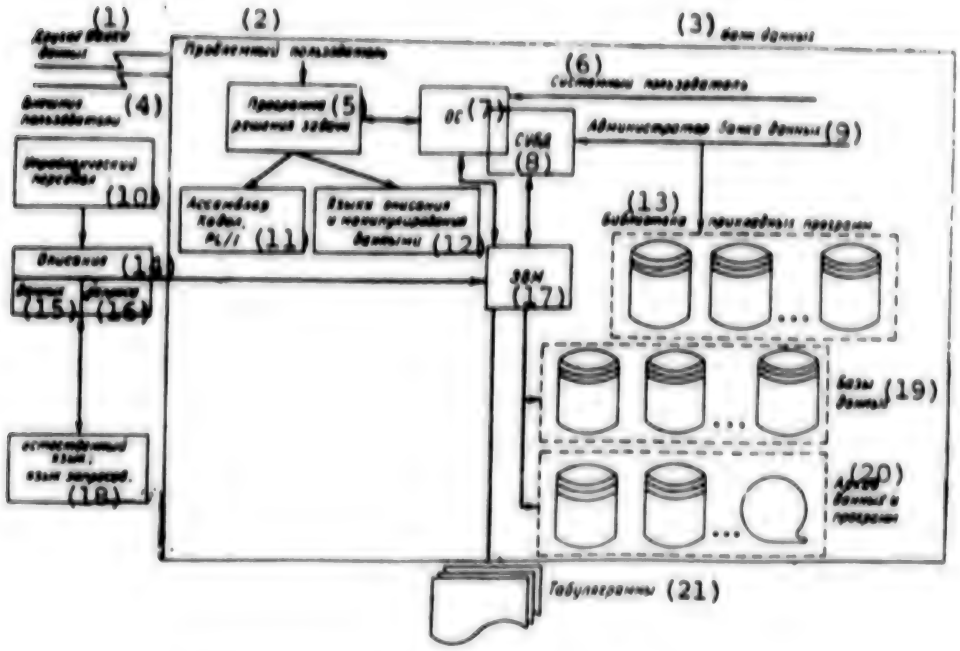
Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, 1980 pp 32-34

[Article by Doctor of Economic Sciences A. B. Ivanov and Engineer N. V. Tychina]

[Text] Improvement of the computer and of its hardware and software, development of information processing methods and the desire of management personnel to receive operational data on the status and course of production processes by an arbitrary (not previously fixed) number of features regularly required conversion to qualitatively new data processing systems which have been named data banks.

A data bank may be determined as an aggregate of hardware, software and language facilities designed for centralized accumulation, constant updating and collective use of the data of a complex structural organization. The data bank is the supporting part of the ASU [Automated control system] and is a dynamic information model of the controlled object which is permanently maintained in a state of constant and accurate conformity to the controlled process. The main components of a data bank are the data bases, program components (operational systems and data base control systems), language facilities of the users' (management personnel and programmers) communications with the data bases and hardware (third-generation computers).

The data bank may be regarded in several aspects (see figure). From the viewpoint of implementing the functions of a data processing system, the bank assumes the presence of outside and internal users, a computer with the required number of external (magnetic tape and magnetic disc stores) and peripheral devices (terminals) which perform the necessary conversions and data processing. The outside user (nonprogrammer) formulates the request or problem and receives the information needed to make management decisions. Internal users (programmers) participate directly in the technological process of data preparation and processing on the computer. The data bank, as an information system, contains data stocks (data bases, data descriptions and archives) and programs (applied programs).



Functional Diagram of Data Bank

Key:

1. Other data banks
2. Problems user
3. Data bank
4. Outside users
5. Problem-solving program
6. Systems user
7. Operating system
8. Data bank control system
9. Data bank administrator
10. Management personnel
11. ASSEMBLER, COBOL, PL/I
12. Data declaration and manipulation languages
13. Applied program library
14. Declaration
15. Data
16. Request
17. Computer
18. Natural language; request language
19. Data bases
20. Data and program archives
21. Tabulograms

Data bases--the aggregate of a large volume of data organized in a special manner--include input data for problem-solving of users and issue of request lists. Data bases are constantly renewed and corrected with regard to current changes in the control system and object. Hence, there is a need for special program components which perform the functions of data base accumulation, actualization (renewal) of them, support of reliability and also collective access of applied programs to general data. These components, called data base control systems (SUBD), have already been worked out for use in various ASU. Thus, applied programs in a system based on data bank concepts refer directly to the SUBD for data, which organizes input, search and retrieval of information from the base. The SUBD supplements the operating system in control of data and ensures adaptation of data processing systems to variable use conditions.

The following SUBD included in the central fund of algorithms and programs of automated control systems (TsFAP ASU) as part of the Scientific Production Association Tsentrprogrammsistem (Kalinin) are presently most well known: the data integraton and processing system (SIOD-1,2), a universal structure data bank (BANK) and a system for administering the data banks of the hierarchical structure (SINBAD-2). The NABOB and OKA data bank control systems have not yet been included in the TsFAP ASU. Besides the SUBD, the KAMA remote data processing systems, which have direct access to data from territorially remote users, are used extensively in data processing practice. Various SUBD differ considerably one from the other in their capabilities, principles of data base organization, methods of access to data, language facilities for communication of users, requirements on the operating modes and configurations of computers and so on. The characteristics of various SUBD and the prospects of their use may be given.

Open (with basic or actuating language) and closed SUBD are distinguished by the principle of construction. In systems of the first type, the data in the base are accessible to the applied program (recorded in one of the algorithmic languages ASSEMBLER, COBOL, P2-I and so on, called basic or actuating languages in this case) of special language facilities rather than by means of the operators of this language. The special language facilities may be the expanded programming language in which the program is written, specific SUBD facilities or an independent language called a data manipulation language (YaMD). The user of a system with basic language is regarded as professional programmer in the sense that he must write the sequence of operators which control the computer precisely the same as in traditional programming in algorithmic language for solving the problem.

In systems with closed organization, access to data is accomplished without resorting to traditional programming. The possibility of controlling the conditions and procedures of processing is achieved by using a preprogrammed or built-in algorithm, by which the volume and complexity of the operations charged to the users are reduced. Thus, if there is a SUBD of this type, the user describes the data elements in the base and the algorithm for processing them in a special language adapted for specific conditions, while the applied program is formulated as a request to the SUBD for processing. The user of this system may be a nonprofessional programmer, i.e., management personnel who have mastered the special language of request declaration and the required data.

Programs which realize SUBD functions should be compact, should require minimum consumption of machine resources and should therefore be written in a low-level language--ASSEMBLER.

The SUBD is usually analyzed for the following main trends (Table 1):

the functional capabilities of the system;

the operational situation;

the flexibility of the data processing system;

the ease of operation;

the permissible structures of the data realized by the system;

the language facilities for communication of users with the data bases.

The functional capabilities of the SUBD are determined by its orientation to the complex of ASU problems (subsystems) solved. For example, the SUBD BANK, SINBAD-2, NABOB and OKA are universal general-purpose systems and are designed to create, actualize and realize access to data bases, the content and composition of which are determined by the requirements of the users for solving a wide range of ASU problems. The SUBD SIOD-1 and SIOD-2 are designed to service the data bases which contain design-technological information and are used to solve operational planning problems and material and technical supply problems in the ASUP [Automated enterprise management system].

The operational situation is characterized by the composition of the external devices designed for data storage included in the base, by the type and version of operational system functioning jointly with the SUBD and by the operating mode of the computer equipment. Knowledge of these characteristics is essential for selection of the SUBD since it determines the functional capability of data processing systems under specific use conditions.

The flexibility of the SUBD is evaluated as a function of the possibility of simultaneous access of several users to the data base, the set of external storage devices (the number of disc guides and the capacity of direct-access storage devices) and of the possibility of making changes to the data base without changing the programs. Moreover, the factors which determine the flexibility of the SUBD should include the capability of increasing the SUBD with equipment designed to solve special user problems not provided by the algorithms built into the system and also the capability of adapting the SUBD to a wide range of processed information determined by the multiaspect nature of the user interests.

The ease of system operation is understood as those properties by which the possibility of using the SUBD under specific conditions is facilitated. This is realized to a significant degree by the presence of so-called user points by which the applied program packets contained in the SUBD are tied to specific conditions and also by fixed program generation parameters, language description facilities and data display in the system.

The data structures realized in the SUBD are an important and the least standardized indicator of the system. The unanimity (or compatibility) of the procedure and data declaration facilities is the most important

Comparison Parameters	Data Bank Control Systems	
	SIOD-2	BANK
Sphere of using data banks realized on basis of SUBD	ASU of machine building enterprises with serial and large-series type production	
Functional designation	Operational control problems and material and technical support	Universal designation
Type of operating system and operating mode	DOS YeS, beginning with version 1.3	DOS YeS, beginning with version 1.3
Operational situation	64K of internal storage, 2 NMDs and 1 NML	128K of internal storage, 2 NMDs
Computer model on which SUBD can be realized	YeS-1020 and above	YeS-1020 and above
Type of SUBD	Mixed	With basic language
Permissible data logic structure	Network	Network
Basic algorithm language	ASSEMBLER, PL/1 and COBOL	ASSEMBLER, PL/1 and COBOL
Access methods used	Combinations of index-sequential and direct	Direct by key and by address with respect to the main recording
Language facilities:		
outside user (non-programmer)	Parametric languages for generation of data processing procedures	---
problems user (programmer)	Macroinstructions of data declaration and access included in ASSEMBLER, COBOL and PL/1 languages	Macroinstructions for description of data base structures and data search included in ASSEMBLER, COBOL and PL/1 languages
systems user (programmer)	Macroinstructions of ASSEMBLER language	
data bank administrator	Program generation parameters	Macroinstructions of ASSEMBLER language

[Table continued on following page]

[Table continued from preceding page]

Comparison Parameters	Data Bank Control Systems	
	SINBAD-2	NABOB
Sphere of using data banks realized on basis of SUBD	ASU of enterprises, nonindustrial objects and sector ASU	
Functional designation	Universal designation	
Type of operating system and operating mode	OS YeS (MVT, MFT) of any version	DOS YeS, beginning with version 2.0
Operational situation	256K of internal storage, 3 NMDs and 2 NMLs	256K of internal storage, 3 NMDs
Computer model on which SUBD can be realized	YeS-1020 and above	YeS-1020 and above
Type of SUBD	With basic language	
Permissible data logic structure	Hierarchical	Network
Basic algorithm language	ASSEMBLER, PL/1 and COBOL	---
Access methods used	Hierarchical: sequential, index, direct and index-direct	Index-sequential for organization and direct by key for access
Language facilities:		
outside user (non-programmer)	---	---
problems user (programmer)	Data manipulation language included in ASSEMBLER, COBOL and PL/1 languages	Data declaration language of system and language for data declaration of subsystem
systems user (programmer)	Macroinstructions of ASSEMBLER language	Macroinstructions of PL/1 language
data bank administrator	Language for description of data base structure	Language for data declaration of system and language for data declaration of subsystem

[Table continued on following page]

[Table continued from preceding page]

Comparison Parameters	Data Bank Control Systems	
	OKA	KAMA*
Sphere of using data banks realized on basis of SUBD	ASU of enterprises, nonindustrial objects and sector ASU	
Functional designation	Universal designation	
Type of operating system and operating mode	OS, YeS (MVT, MFT), beginning with version 4.0	OS YeS (MVT, MFT), beginning with version 4.0
Type of operating system and operating mode	512K of internal storage, 4 NMDs and 2 NMLs	512K of internal storage, 4 NMDs and 1 NML
Computer model on which SUBD can be realized	YeS-1020 and above	YeS-1022 and above
Type of SUBD	With basic language	---
Permissible data logic structure	Hierarchical	---
Basic algorithm language	ASSEMBLER, PL/1 and COBOL	---
Access methods used	Hierarchical: sequential, index-sequential, direct and index-direct	Sequential, index-sequential, direct, index-direct and indirect
Language facilities:		
outside user (non-programmer	---	---
problems user (programmer)	BETA language	Macroinstructions included in ASSEMBLER, COBOL and PL/1 languages
systems user (programmer	BETA language	Macroinstructions of ASSEMBLER language
data bank administrator	BETA language	---

Note: MVT--multiprogram operating mode of computer with variable number of tasks; MFT--multiprogram operating mode of computer with fixed number of tasks; NMD--magnetic disc store; NML--magnetic tape store.

*Remote data processing system.

condition for increasing the flexibility and ease of operation of the SUBD. Unanimity in display of data processing procedures is achieved to a significant degree by standardization of programming languages. The problem of unanimity in data display, despite advances in development of unified classifications and nomenclatures in the country (for example, the unified system for classification and coding of technical and economic information) is far from a solution. The unified classifications of nomenclatures now developed in ASU encompass individual, although mass, categories of data elements and only a small part of the relationships among data.

Almost all the existing SUBD are oriented by their own disadvantage toward processing a completely specific structure. The data structures are different in different SUBD. Comparative characteristics of the data elements used in various SUBD (Table 2) permits one to conclude that there is no unified terminology related to identification and description of data elements; mutual understanding of the specialists operating different SUBD is difficult; and it is frequently impossible to compare the functional capabilities of different SUBD or large time expenditures are required. Thus, solution of problems of unanimity in representation of data structures and the relationships among data elements are the most important path toward standardization of SUBD and data processing systems realized on their basis.

Before giving the characteristics of the language facilities for user communication with data bases, the concept of user should be refined. Any person who interacts through information with data bases is called a user. The following user categories may be distinguished in the general case (see figure):

external user (nonprogrammer) having no knowledge of the characteristics of data base construction; he communicates with data bases by means of the characteristics of objects known to him through a problems user or directly by means of hardware (terminals);

the problems user (programmer) should know the logic structure of data organization in the base, but may not know the objects represented by the data and their storage characteristics;

the systems user (programmer) is informed in all questions related to data storage and the structure and functioning of the operational system and the SUBD;

the data bank administrator is a person or group of persons responsible for organization and maintenance of data in a state satisfactory to the information needs of other users.

To the given user categories should be added that user-programmer and user-nonprogrammer concepts primarily characterize the functions which they perform.

Table 2. Main Logic Structural Elements of Data Bases

SUBD	Logic Structural Data Elements					
Terms used in traditional data processing system	Elementary	Data group	---	Recording	File	---
SIOD	Field	Recording	Small chain	---	File	Data base
BANK	Data field	Data group	Chain	Recording	File	Data base
SINBAD-2	Field	Segment	---	Recording of logic data base	---	Logic data base
NABOB	Data element	Aggregate of data	Set	Recording	Domain	Data base
OKA	Field	Segment	---	Recording of logic data base	---	Logic data base

The language facilities for user communication with the data bases can be reduced to the following groups:

programming languages for writing the specific problem-solving programs;

language facilities which ensure the relationship of the applied program and SUBD;

the language facilities of nonprogrammer users for indicating the parameters of the input and output data and problem-solving or request-processing algorithms;

languages for describing data at the logic level, which is a means of indicating the data structures of SUBD which will be encountered in user programs;

languages for describing data at the physical level for controlling the disposition of data in physical devices, methods of addressing and retrieval of them.

It should be noted in conclusion that unification and standardization of SUBD is a most important problem. The absence of unification and standardization makes it difficult to construct distributed data banks and the capability of data exchange between systems which function at different levels of the national economy.
[193-6521]

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USSR UDC 002.5:65.011.56:65

INTEGRATED INFORMATION FLOWS IN ASUP

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, 1980 pp 36-38

SHNAYDERMAN, I. B.

[Abstract] An integrated data processing system is organically related to many aspects of information and procedural processes of control. This requires a fundamental change of the traditional information flows and their time characteristics. Information flows and procedural processes are symbolized by concentric rings with a center denoting a processor where the data are converted. Information is circulated through the outer ring to superior directive organizations or data are transferred for bookkeeping and statistical accounting. The second through the eighth rings of the graphic model of the integrated data processing system symbolize the nature of the management apparatus, the amount of circulating information, the flows of resulting information obtained from the data processing center, the information files which comprise the information fund of the data processing center and information on the organization and technology of data processing such as programs, instructions, optimization models and so on. Analysis of the problems solved during control of material resources reveals the summary situation. A specific pattern is provided by analysis of the consolidated problems solved during control of finished product output and sales. Analysis of the information flow in the integrated system of an automated enterprise management system reveals irregular information flows. Flows in the vertical direction are densest, which is explained by the compedency of the algorithm for realizing the control functions. Figures 1.

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CSO: 1863

NEW PROGRAMS, SYSTEMS FOR CONSTRUCTION USE OF COMPUTERS REPORTED

Moscow NA STROYKAKH ROSSII in Russian No 1, 1980 p 29

[Article: "The Sirius System"]

[Text] The sectorial fund of programs and algorithms of USSR Gosstroy has received the new Sirius system.

It is a general-purpose system designed to develop large program packages used in the most diverse fields, including writing software for automated control systems, automated design, and automated engineering calculations. Use of the Sirius system permits a 30-50 percent increase in the labor productivity of programmers and algorithm writers while insuring uniformity of software and hardware.

The development of any program package using the Sirius system involves several types of work which require different qualifications. This gives a practical opportunity to follow the principle of division of labor in any established collective of workers.

The Sirius system has three high-level input languages: a data description language; the general SPL/1 language designed for program modules that refer to the data base; and a model description language (a knowledge of the PL/1 language is necessary for rapid incorporation of the Sirius system).

The package is developed in parallel in the three languages. The system is integrated because it offers users a set of interrelated means, each of which helps perform different modules of the program package.

The system has an internal memory that allows it to work with large files.

The Sirius system operates within the framework of versions 4.0 and 4.1 of the YeS operations system. For efficient use of the system the computer must have an immediate-access memory of at least 256K and three YeS-5050 or YeS-5061 disc drives.

The system was developed at TsNIPIASS [Central Scientific Research and Experimental Planning Institute of Automated Systems in Construction] and

has been included in the sectorial fund of algorithms and programs (codes V-48 and V-49).

New Arrivals

1. A package of programs for calculating the structures of water supply and sewage systems with conical or flat rounded bottoms (SPARKOD), YeS computer, disc operating system, FORTRAN (code I-250).

2. Program for determining the optimal technical equipment and layout for a loading area operated on an individual basis and cooperatively, YeS computer, disc operating system, FORTRAN (code II-36).

3. Automated system to monitor fulfillment of the internal capital construction plan by production and nonproduction projects at organizations of a construction ministry (ASKOS), YeS computer, operating system, PL/1 (code III-87).

Information concerning rights to use the USSR Gosstroy fund of algorithms and programs may be received from this address: 117393, Moscow, GSP-312, Novyye Cheremushki, Block 28, Building 3. TsNIIPIASS. Tel. 120-10-42. Teletype: 111850.

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CSO: 1863

USSR UDC 519.14

ANALYSIS OF THE EFFECTIVENESS OF COMBINATORIAL ALGORITHMS FOR THE RETRIEVAL OF EXTREMAL TREES ON WEIGHTED ORIENTED GRAPHS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 11, 1979 pp 134-141 manuscript received 19 Jan 79

KLETIN, V. A., Moscow

[Abstract] The effectiveness of combinatorial programming methods with respect to the problem of finding the minimal "partial" tree on a weighted oriented graph is investigated. To this end, various combinatorial algorithms are considered (algorithms of the branch and boundary type, randomized algorithms, local optimization algorithms). It is shown that branch-and-boundary type algorithms assure obtaining an optimal solution. Randomized algorithms, on the other hand, while not assuring an optimal solution, serve to obtain adequate solutions with a likelihood that is the greater the number of solutions considered. As for local optimization algorithms, they yield locally optimal solutions. These findings were verified with the aid of a random number generator in FORTRAN 4 experiments. Figures 4; references 11 Russian.
[167-1386]

COLLECTIVE COMPUTING CENTER OPENS IN TULA

Moscow PRAVDA in Russian 23 Jan 80 p 3

[Article by N. Makharinets, Tula: "Electronics for Everyone"]

[Text] The first phase of a collective-use computing center organized on the basis of the oblast state statistics information-computing center has been accepted for test operations. The center has a third-generation computer.

Establishments like this are being introduced today in Tomsk, Tallin, and Riga. The scientific research and production planning institutes of the USSR Central Statistical Administration, the Institute of Cybernetics of the Academy of Sciences Ukrainian SSR, and the Tula Automated Control System Design Bureau of the Ministry of Instrument Making, Automation Equipment, and Control Systems participated in setting them up.

These centers make it possible to use computer equipment more efficiently in the national economy. This kind of development was envisioned in the resolutions of the 25th CPSU Congress. The new center in Tula has undertaken first of all to serve the many enterprises and institutions that do not have their own computer equipment. It will help them in performing a broad range of accounting, planning, and management problems. Computer equipment will be used extensively in the organizational and administrative work of oblast executive bodies for the first time here. Thus, the automated oblast system is under construction.

The calculated economic efficiency of the first phase of the Tula Computing Center has been figured at more than 2 million rubles, and the costs of setting it up will be repaid in two years.

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CSO: 1863

USSR UDC 658.012.011.56:001.893.681.3

AUTOMATIC ASU DEVELOPMENT MONITORING SYSTEM

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, 1979 pp 7-10

LIN'KOV, V. A., Science Consultant, Main Administration of Computer Technology and Control Systems, State Committee for Science and Technology

[Abstract] An automatic system for monitoring R&D work on automated control systems (ASU) is being experimentally introduced by the Main Administration of Computer Technology and Control Systems, State Committee for Science and Technology (GKNT). The system is based on computerized analysis, processing, and storage of documents reported each mid-quarter from all sources responsible for ASU R&D work. The principal elements of the system include a work-sheet input-data signal, concept code lists (encoders), composite output-data tables, operations plans (plans for introduction of achievements of science and technology, programs of activities to solve major scientific and technical problems) pertaining to ASU and computer technology, and system operating instructions. The system will enable the GKNT to monitor and assure the on-schedule introduction of ASU at enterprises and organizations. Ultimately, the system will be expanded to assure automated monitoring of all technological R&D work in the USSR. Figure 1.
[154-1386]

USSR UDC 502.7:517

ENVIRONMENTAL AIR POLLUTION ASU

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, 1979 pp 4-6

ZHAVORONKOV, YU. M.

[Abstract] A systemic approach to the complex problem of environmental protection is considered. In this connection, the concept of an air quality ASU [automatic control system] is tentatively formulated. A mathematical model of interaction between man and environment is constructed from the standpoint of pollution control. The synthesis of the air quality ASU requires development of emission models serving to compute anthropogenic and natural air pollution as well as models for prognosis of the state of the biosphere, man-machine models for planning optimal conservation strategies, and social, legal, and economic measures. The air quality ASU would consist of the following subsystems: recording of emission, aerometric, and air protection data; a problem-oriented data bank; planning of maximum

air-conservation strategy; administrative control of air conservation measures. Thus the solution of the problem is accomplished owing to automation, systematization, and centralization of the information gathering activities, the allocation of resources on the basis of optimal models, and the coordination of territorial and industrial plans. The planning should proceed from such premises as the maximum permissible levels of pollutants in air, water, and soil, as well as the adoption of the so-called supplementary control systems. A local air-basin quality control ASU is being developed on the basis of these ideas at Kemerovo, and will be incorporated as a subsystem in the municipal ASU; its first stage is scheduled for activation in 1980. Figures 2; references 6: 2 Russian, 4 Western.
[154-1386]

UDC 622.61;625.282-83

SYNTHESIS OF THE LOGIC CONTROL DEVICE OF AN ELECTRIC MINE LOCOMOTIVE

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, 1980 pp 14-15

[Article by engineer V. L. Konyukh]

[Excerpts] A promising trend in automation of underground rail transport is conversion to automatic driving of the train through the mines. An automatic pilot is installed in the cab of the electric locomotive and contains a controlled speed receiver V_e(PZS), a complex of monitoring and safety sensors (DKB), a logic control device (ULU), a system for automatic regulation of the traction and speed V_f(SAR) and an actuating device block (BIU).

The structural layout of the ULU contains 36 elementary sequences of junctions and 36 elementary sequences of outputs. Six reduced sequences of junctions and nine reduced sequences of outputs were achieved after minimization. The complexity of sequential description (the total of rank of all the conjunctions) was reduced from 576 to 138. To check the adequacy of the produced automaton to the initial layout, the minimized sequences were transformed to a system of logic functions on which a simulation model of the ULU in FORTRAN language was constructed. The junctions and outputs of the model upon delivery of the input combinations controlled by the layout were checked on a BESM-6. After the model was corrected, it was tested for the complete set of 128 combinations of input words and states which confirmed the correctness of functioning of the ULU in all situations. A block diagram of the ULU on an AND-NOT basis on a series of K-155 microcircuits contains 48 KlLB554 bodies. The simplified version of the ULU on Logika-ET components and relays is realized in the automatic pilot device of the 14KR-2A electric contact locomotive developed at the Institute of Mining of the Siberian Department of the USSR Academy of Sciences and which has undergone experimental-industrial operation. [193-6521]

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CSO: 1863

UDC 665.63.048:338.984

AUTOMATION OF SOLVING THE MAIN PRODUCTION PLANNING PROBLEMS OF A PETROLEUM REFINING PLANT

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, 1980 pp 34-35

[Article by Doctor of Technical Sciences R. A. Aliyev and Candidates of Technical Sciences V. P. Krivosheyev and M. I. Liberzon]

[Excerpts] The indicators of the main production plan of a petroleum refining plant determine to a significant degree the level of the technical-economic indicators of the enterprise's activity. Optimization of the current plans of an enterprise is one of the main directions for complete use of production reserves and for increasing its efficiency.

The optimum main production planning problems are now the main and most effective problems contained in the ASU NPZ [Automated petroleum refining plant management system] developed in the sector. The experience of operating them at petroleum refining plants indicates that the saving from optimization of production plans comprises 250,000-300,000 rubles.

Functioning of the optimum planning problems of NPZ is related to special adaptation of models to the dynamic conditions of production, the need to carry out multivariant calculations and to solve large-dimension problems within limited deadlines, which places high requirements on automation of solving these problems. One of the main problems in this case is working out programs designed for automatic formulation of models of planning problems based on input information prepared in a form convenient and natural for the user and also programs which permit representation of the results of solution in a form required by the user.

A unified complex of these programs for YeS EVM [Unified computer system] is proposed.

The proposed scheme for automation of planning problems is being implemented on the YeS-1022 in the ASU of the Novo-Baku Petroleum Refining Plant imeni Vladimir Il'ich.
[193-6521]

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CSO: 1863

UDC 331.875.4

CHARACTERISTICS OF INFORMATION USERS IN ASUP

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, 1980 pp 37-40

[Article by Candidate of Technical Sciences V. Ye. Khodakov]

[Excerpts] In most cases the ASUP [Automated enterprise management system] has information and reference functions; information servicing systems (SIO), whose main functions are as follows, operate as subsystems:

vision of user information;

preparation and performance of procedures for automatic exchange of information with superior and related systems;

ordering of the information base.

The basis of the SIO is the hardware complex (KTS), territorially dispersed with regard to conversion and display of information to different users. The SIO has special significance for ASUP where the users are the enterprise managers, middle-level managers, operational-dispatcher personnel and various subsystems of the ASUP. The characteristic operating feature of users in the ASUP is the fact that management decisions are made under conditions of incomplete and frequently variable information which has a low level of reliability.

The volumes of information, the information sources and the characteristics of flows become known after the information needs of the users are studied. All this permits one to go on to selecting the forms of information display, to determine the number of issued forms of documents (working and reference materials) and to determine and locate the KTS of SIO and the functioning modes of the SIO. The SIO is characterized by the static nature of the structure of the main information files and information conversion procedures. The SIO in the ASUP NPZ [Automated enterprise management system of a petroleum refining plant] is realized on the basis of the M7000 UVK [Process control computer complex] and DM-2000 display modules for display of alphanumeric information as the main type employed

in the computer are used as territorially dispersed video terminals. The capacity of the DM-2000 ELT [Cathode-ray tube] screen permits formulation of all the required formats and frames; the display modules are installed near the main users.

The ASUP NPZ is realized on the basis of the M4030 computer. The number of output formats of recordkeeping-reference information formed on the video terminal screens during the first stage is 20 and the number of their basic formats is 10. Each format is one information model. The number of arbitrary formats is not limited to 10 and may be increased. When selecting the formats of recordkeeping-reference information, the frequency of using the information contained in it was taken into account. Indicators with 70 percent or more level of significance for the main users in the ASU were included in the formats. Output information is issued both in regulated and in reference modes. The regulated mode is the main one.

The use of SIO in ASUP improves information servicing and contributes to a reduction of tension in the user's work.
[193-6521]

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CSO: 1863

VOLGA STEAMSHIP LINE BOOKKEEPING COMPUTERIZED

Moscow RECHNOY TRANSPORT in Russian No 9, 1979 p 22

[Article by Candidate of Technical Sciences L. Kolesnik, Volgograd Centralized Bookkeeping Office of the Volga United River Steamship Line (VORP): "Using Electronic Computers"]

[Text] In the Volgograd Centralized Bookkeeping Office of the Volga United River Steamship Line (VORP) a problem group has been developed and introduced called "Accounting of Fixed Capital," which is a component of the "Bookkeeping and Reporting" subsystem of the "Port" automated control system and the "Zavod" [Plant] automated control system.

Automation of calculations on an electronic computer of the M-5000 type for recording fixed assets is considerably more effective in comparison with the calculations of other sections of bookkeeping, since a large volume of constant data is input one time and used repeatedly. Here the potentials of the electronic computer are used more fully: high speed when performing such procedures with data arrays as ordering data, data sorting, selection, grouping and printing, and also calculating and logical operations.

The algorithm of automated calculations for the set of problems called "Accounting of Fixed Capital," realized in Assembler programming language, provides for: monthly entry of amortization for full replacement and capital repair of inventory objects, particularly motor transport, depending on the mileage; entry of objects used for hauling freight and for handling operations, depending on the planned operating period in each month; objects of the exchange fund, and also those in the reserve, depending on the nature of operation, and others.

The data arrays are adjusted every month according to the degree of withdrawal and transfer of fixed capital within the enterprise. The data contained in them make it possible to take account of the presence, receipt and withdrawal of fixed capital, and the formation of bookkeeping entries for balance sheet account 01, "Fixed Capital," in correspondence

with balance sheet account 85, "State Fund." These data permit calculation of the sums of amortization of fixed capital for complete replacement and capital repair according to sectors of the national economy, spheres of their application, and classification groups; distribution of amortization according to ciphers of production outlays, the formation of bookkeeping transactions for balance sheet account 86, "Amortization Fund," in correspondence with the balance accounts for which the outlays for production are taken into account; the formation of data for determining payments to the budget, for inventorying fixed capital, for the annual report, for bookkeeping entries for balance account 02, "Wear of Fixed Capital" in correspondence with balance sheet acount 85, and others.

Data codes were developed in the process of planning the problem group.

A punchcard file was set up on the basis of the encoded inventory cards for accounting of fixed capital (standard form No. OS-6, No. OS-7). It has been recorded on a magnetic disc and a permanent data array has been created.

At the end of a month's time the inventory cards, grouped according to types of operations, are transmitted for keypunching, and created on the basis of the latter is the file for movement of fixed capital and adjusted is the file of inventory cards. In addition, data on the mileage of the motor transport are input monthly. Later the formation of the files (carried out with the use of permanent and normative-reference data) and printing of output documents are pe formed in an automated regime. for one enterprise five surfaces of magnetic discs and 3.5 hours of machine time are required for solution of the problem group "Accounting of Fixed Capital."

The process of preparing the permanent data for the problem "Accounting of Fixed Capital" on an electronic computer is very labor consuming and lengthy, therefore a new algorithm was developed for calculating the wear with respect to the inventory objects of fixed capital, which made it possible to reduce the manual labor outlays of workers in the bookkeeping department and the time for data preparation.

At the present time calculations for the problem group "Accounting of Fixed Capital" using electronic computers are being performed for four enterprises of the steamship line.

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CSO: 1863

COMPUTER CONTROL OF DREDGING TECHNOLOGY

Moscow RECHNOY TRANSPORT in Russian No 9, 1979 pp 40-41

[Article by V. Vlasov and V. Osipov, candidates of technical sciences, NIIVT: "Automated Control System for Dredging Technology"]

[Text] The technological process of dredging is characterized by a large number of variable parameters. Therefore during manual control it is not always possible to insure the optimum dredging regime, which lowers the effectiveness of performance and the quality of the operations, especially for hydraulic dredges of high productivity.

An increase in the productivity and quality of dredging operations can be attained as a result of complex automation of the whole technological process of dredging using process control electronic computers. The introduction of process control computers during dredging causes significant changes in the organization of the whole technological process. The computer makes it possible sharply to increase the number of parameters that can be regulated simultaneously and in case of a change in external conditions it can quickly be restructured for a new control variant, insuring the optimum operating regime of the hydraulic dredge under the changed conditions.

In the NIIVT [Novosibirsk Institute of Water Transport Engineers] according to an assignment from the Main Administration of Waterways and Hydraulic Engineering Structures (Glavvodput') of the Ministry of the River Fleet an automated system was developed for control of technological dredging processes (ASUTP; avtomatizirovannaya sistema upravleniya tekhnologicheskimi protsessami dnouglubleniya), which consists of two parts. The design-research part is the subsystem "Izyskaniya" [Search], and the dredging part which includes three subsystems: "Orientation," "Ground Draft" and "Control of Auxiliary Operations." All the subsystems are united in the set of the process control computer. In 1977 it was installed for the first time in the house of the "Tom'" hydraulic dredge (plan No. 1-517-01) of the Novosibirsk technical section of the line. In 1978 the apparatus was used during the whole navigation period.

A channel survey of a section of the river is made and a program for operation of the suction dredge is compiled using the "Search" subsystem. The materials of the searches are processed on the electronic computer. During this processing a plan of the section of the river is mapped, and the amount of soil to be removed is estimated. After dredging, control surveys of the worked section are performed, the amount of dirt removed is estimated and the quality of the jobs performed is evaluated.

Two specialists were introduced to the make-up of the crew of the "Tom'" hydraulic dredge to perform the research operations: the hydraulic engineer (chief of the party), combining the occupation of mariner, and the automatic equipment engineer. The surveying apparatus is mounted in the boat housing of the KS-100 type, and includes a radionavigation system, using which the coordinates of the survey vessel are determined, and a digital echo-sounder and puncher, on the tape of which the coordinates of the survey points and the depth are recorded periodically.

Used in the automated control system is a short-range range-finding radionavigation system (RNS), consisting of two retransmitter radio stations installed on shore, and an on-board device. The distances from the craft to the shore radio stations are measured using the RNS. The accuracy of distance measurement is 1 meter, the range of action of the system is 5 kilometers. The radionavigation system is outfitted with a right-angle coordinate computer and a digital decimal indicator. Guided by the readings of this indicator, the mariner has the opportunity of shifting the craft in parallel lines over any given distances.

A digital echo-sounder is used for measuring the distances. Insured by the use of it is increased accuracy of measurements by averaging the data of 10 measurements. The cycle of 10 measurements lasts for 1/3 of a second. The result is punched in and put out on the indicator. In addition, provided in the echo-sounder is calibration of the frequency of repetition of the pulses, making it possible to reduce the errors caused by the change in speed of distribution of the ultrasound during fluctuations in the temperature of the water. Using this echo-sounder the depth is measured even in a silty stream of water, particularly from on board an operating hydraulic dredge. Under such conditions ordinary echo-sounders operate unsatisfactorily due to the passage of pulses reflected from the bottom. The given echo-sounder makes it possible to measure the time intervals between the arrival of the pulse reflected from the bottom and the sounding pulse following after it. In addition the time of the propagation of the pulse to the bottom and back is determined as the difference between the period of repetition of the sounding pulses and the measured interval of time. Thanks to the accepted method of measurement the errors caused by the passage of pulses reflected from the bottom are excluded. In cases of passage of reflected pulses the counter is not switched on, and this leads only to an increase in the time between two measurements. The range of measurements of depths is 0.3-20 meters,

and the accuracy is 5 centimeters. A tape perforator of the PL-80 type is used for punching the coordinates and the depths.

The map of the river section is prepared in two stages. First a shore outline is made, and the location of the navigation condition signs and the shore geodesic signs is determined. When necessary the direction and speed of the current at different parts of the river are determined. In the second stage the depths are measured.

All in all 4-5 hours are spent to survey a section of the river 2-3 kilometers in length. The punched tape obtained during the explorations is supplied to the hydraulic dredge where it is processed on an electronic computer.

Used in the automated control system is a small high-speed process control electronic computer of the "Elektronika-100I" type. The minimum package of the machine includes a processor with a memory of 4096 12-bit binary words, an input device with punched tape, a perforator and an electric printer. The "Elektronika-100I" electronic computer based on integrated microcircuits has increased reliability and can operate for an extended period without service. The average time between failures is 10,000 hours. It is planned to power the electronic computer from the ship system with a voltage of 200 volts and a frequency of 50 hertz. The intake is 1 kilowatt. The weight of the whole package is 180 kilograms. The cost is 20,000 rubles.

Two programs have been compiled for processing the materials. According to one of them a map is drawn of the section of the river and according to the other the volume of earth is computed. The map is drawn on a board of a two-coordinate plotter on a scale of 1:10,000. The shore outline is put on the map, the location of the floating and shore navigation situation signs is marked, and isobaths are plotted.

In order to calculate the volume of earth, fed into the electronic computer are the section coordinates, the depth of dredging, the number of the trenches and series. The computer prints out the amount of earth extracted, the average thickness of the removed layer and the area for each trench and the whole cut. The processing time of the array, containing 1,000 points, is about 5 minutes.

The "Search" subsystem makes it possible to automate completely the process of surveys on the rivers, to increase significantly the productivity of labor and the quality of data obtained, and to facilitate the processing of field materials.

The "Orientation" subsystem is intended for automatic control of movement of the hydraulic dredge according to the given directions and in the given limits. This subsystem makes it possible to work out a bypass with individual trenches of any width and length, and then it is not required to place range markers on the shore. The subsystem consists of

a radionavigation system, using which the coordinates of the hydraulic dredge are determined, a control unit and an electronic computer. Transmitted through the control unit are the direction of the dredging range, the length and width of the trench and through it there is automatic control of the electric drives of the lateral winches of the suction dredge. The trajectory of movement of the hydraulic dredge is drawn on the plotter board on a scale of 1:1,000.

The radionavigation system installed on the hydraulic dredge is analogous to the radionavigation system used for explorations. The retransmitter stations are located in special boats near the shore. The stations can be installed at arbitrary points both on one or on the two banks of the river. The signals from the output of the radionavigation system in the form of a binary digital code are input through the interface into the electronic computer where the points at which the hydraulic dredge is located are computed and compared with the assigned coordinates. The computer processes electric signals in proportion to the displacement of the hydraulic dredge from the given direction. These signals are fed to thyristor transformers of the bow butterfly winches, which insures automatic movement of the hydraulic dredge according to the given direction with an error of not more than 1 meter.

In the 1978 navigation season the "Orientation" subsystem was used for over 2,000 hours on the "Tom'" suction dredge. The given apparatus makes it possible to increase the productivity of the suction dredge and the quality of the operations, and also to reduce the times for working the slot. In addition, the work of the dredging specialist is eased considerably. The subsystem makes it possible to work the slot with trenches of any width, thanks to which with small thicknesses of the removed layer there is an increase in overdeeping, but at the same time there is an increase in the width of the trench, which contributes to an increase in the productivity of the hydraulic dredge. The operation of the "Orientation" subsystem is not affected by conditions of the weather, the location, or vessels passing the hydraulic dredge.

The "Ground Draft" subsystem is intended for measurement of the productivity of the hydraulic dredge, calculation of the volume of earth removed and automatic control of the electric drive of the main winch for the purpose of insuring the maximum possible productivity of the hydraulic dredge under the given conditions. Devices with the aid of which the consistency and output of silt are determined are installed on the "Tom'" suction dredge in order to measure productivity. These values, converted to digital code, are fed into the electronic computer, where the productivity of the hydraulic dredge is computed. The productivity is integrated by time, and thereby the volume of extracted earth is determined. The computer records the operating time of the hydraulic dredge in the dredging regime. The instantaneous producvitity, the volume of earth extracted and the time of net operation are controlled using digital indicators located on the control panel.

Automated using the "Control of Auxiliary Operations" subsystem is the process of movement of the hydraulic dredge from one trench to another, from series to series, departure from a slit for the passage of ships and the return to the former place of operation, and also control of the terminal pontoon.

The economic benefit as a result of introduction of the automated system for control of technological processes of dredging (ASUTP) comes to 70,000 rubles per year for one hydraulic dredge.

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CSO: 1863

COMPUTER DEVELOPMENTS: VERY LARGE, MICRO- MACHINES NEEDED

Kiev POD ZNAMENEM LENINIZMA in Russian No 23, 1979 pp 58, 59

[Article by Viktor Mikhaylovich Glushkov, vice president of the Academy of Sciences Ukrainian SSR, director of the Institute of Cybernetics of the Academy of Sciences Ukrainian SSR, winner of the Lenin and USSR State prizes, and Hero of Socialist Labor: "The Computer's New "Occupations'"]

[Excerpts] The subject is organizing an entire management system based on the use of computers.

In such a system, according to our calculations, 20,000-30,000 computers on different levels must be used nationwide, not including very small machines, and hundreds of thousands of people will be needed.

Our country has also accumulated considerable experience with computerization of design work. Intensive work is underway to formulate automated design systems in sectors of the economy where the complexity and rate of change in articles demand that research and design work be carried out rapidly and on a sophisticated scientific-technical level. Whereas more than 40 organizations were developing automated design systems during the Ninth Five-Year Plan, 47 more are now at work in this area.

The timely problems for computer producers today are building large-capacity machines and inexpensive mini- and microcomputers, which are in very short supply.

During the current five-year plan a transition is being made to a new basic computer element, the fourth-generation large integrated circuit. The production technology for these devices will make it possible to solve two important problems: building supermachines capable of many tens of millions of operations a second, and supporting the production of highly reliable, inexpensive microcomputers for mass use. Because of their small size and low cost they offer entirely new possibilities for the development of automation.

11,176
CSO: 1863

USSR

ECONOMIC UTILIZATION OF GOSBANK'S OASU

Moscow DEN'GI I KREDIT in Russian Oct 79 pp 51-55

VOLKOVA, I. P., candidate of economic sciences

[Abstract] The increasing complexity of money and credit management operations requires the introduction of computer technology in the banking business, and the USSR State Bank (Gosbank) has started to implement this by setting up the first stage of a branch automatic control system (OASU). One of the main operations it is expected to improve will be the use of credit and loans; this will be accomplished with the help of an analysis of the effect of credit on production that is made possible by the capability of performing multivariant and optimum planning on a computer. Money circulation can also be monitored with the help of the OASU because of its information processing capabilities, which make it possible to arrange data in many ways that would be almost impossible to do manually. Since USSR Gosbank's activities have a great deal to do with implementation of the national economic plan, it receives a great deal of information on this subject that reflects the movement of money and products in the production system, from the enterprise to the branch level. The OASU will help put the monitoring and utilization of this information on a much more operational basis.
[136-11746]

USSR UDC 62-5-5(047)

CONTROL OF DISTRIBUTED PARAMETER SYSTEMS (REVIEW)

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 11, 1979 pp 16-65 manuscript received 19 Mar 79

BUTKOVSKIY, A. G., Moscow

[Abstract] The basic and applied research into distributed-parameter control systems performed in the last 10-12 years, chiefly by Soviet authors, is reviewed. Problems of the general theory of distributed parameter systems (DPS) are found to be the same as those relating to lumped parameter systems--they are the problems of optimization, identification, controllability, observability, stability, finite control, synthesis, simulation, and computerized approximate calculations, except that for DPS these problems are much more complex, since the apparatus of the ordinary finite-dimensional differential equations is insufficient for DPS description.

Special emphasis is placed on positional-control DPS, mobile-control DPS, and process control DPS. The range of applications of DPS is continually widening. In particular, their applicability for control of space probes and space power plants is growing. In addition, devices--static electrointegrators--for simulating the responses of a broad class of multivariate quasilinear DPS to the most varied transient effects have been developed. Increasing attention also is being paid to the development of measuring devices and sensors based on DPS. References 533: 501 Russian, 32 Western. [168-1386]

UDC 681.3:656.13

AN ALGORITHM FOR SHAPING THE PRODUCTION PROGRAM FOR ROUTINE AUTOMOBILE MAINTENANCE

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979 manuscript received 8 Dec 78 pp 21-23

[Article by Candidate of Technical Sciences M. N. Bednyak]

[Excerpts] Development and introduction of automated dispatcher control systems (ASDU) in motor transport requires formalization of many production tasks of different complexity and structure. One of the most complex is that of formulating the daily shift task by production subdivisions and services for routine automotive maintenance (TR). Solutions of it permits more efficient use of material and labor resources and also a reduction of automobile idle times during repair. TR planning as an element of operational control is now generally absent or is at an unsatisfactory level at almost all motor transport enterprises. This is explained primarily by the fact that TR of rolling stock is a more complex dynamic system, functioning of which is determined by many random factors, for example, sending the vehicles for repair is random in nature and the type of malfunction or failure is not clearly manifested. Random values are the laboriousness of correcting the failures and malfunctions, the presence of circulating funds and so on.

Postulation and solution of this problem in real time required extensive preliminary work to investigate the automotive repair system both on statistical models and under conditions of motor transport enterprises.

It was established on statistical models that the frequency of sending vehicles for repair is determined by two factors: laboriousness and consequently the time of repair and by the income from operation of the vehicle per unit time. Moreover, the optimum dimensions of the reserves of parts, subassemblies and units and also the optimum organizational structure of the technical service are determined on the models. Based on the investigations, an algorithm was developed and a working program for formulation of the daily shift task by production sections and subdivisions was compiled.

The problem of formulating the production program for rc tine automotive maintenance has been implemented in COBOL-32 language at the ATP-1 [expansion unknown] of the Kievgorstroytrans Trust. The time required to prepare the information and for recordkeeping for an ATP with 550 vehicles comprises 3-3.5 hours.

As a result of realizing the problem, the nonproduction losses related to vehicle idle time during repair was reduced by 27 percent. The saving from realization of the task comprised 28,000 rubles annually.

The developed program is a constituent part of the software for the automated dispatcher control system of the subsystem ASDU TO and TR. [1863/159-6521]

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CSO: 1863

UDC 664.22.002.3:543.053

THE COMPUTER-INFORMATION COMPLEX FOR THE AUTOMATED SYSTEM FOR RAPID ANALYSIS OF RAW MATERIAL QUALITY

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979 manuscript received 10 Jan 79 pp 28-31

[Article by Engineers K. V. Konovalov and I. Ye. Izvolenskiy and Candidates of Technical Sciences V. S. Flon and V. I. Lutsyk]

[Excerpts] When planning the output of a finished product of an enterprise and control of a production process, the quantitative and qualitative indices of the prepared raw material, for which settlement with suppliers is also made, are taken into account. Automated systems for rapid analysis of raw material quality (ASEAK) are created for this purpose.

When introducing ASEAK, one must take into account that each sector has its own approach to the process of receiving the raw material, since acceptance is carried out not only according to quantitative indices, but mainly according to parameters of the quality of the incoming raw material. This causes the occurrence of qualitatively new production relationships between the sectors of the national economy producing and processing the raw material.

ASEAK can be created and introduced at all sectors of the food industry which refine raw material and occupy the lower level of the hierarchy.

An ASEAK includes a receiving terminal with representative sampling device, instrument-analytical complex (PAK) and computer-information complex (VIK). The task of the VIK of the ASEAK is to gather and distribute incoming information throughout the OZU [Internal storage] files, processing it according to given algorithms, printout of the information about the mass and quality of the received consignment and recommendations on specific designation of it.

The VIK operating mode can be adjustment, automatic and auxiliary.

The adjustment mode provides for information input from the computer keyboard or from a photographic reading device and is used to process and

check the VIK operating algorithms prior to the beginning of work by the ASEAK (on checking examples).

The automatic mode realizes algorithms for gathering and distribution of information through the OZU files and processes incoming information.

The auxiliary mode is used for statistical processing of information according to consignments of raw material accepted during the shift, day and so on.

The presence of an operator is obligatory during operation in the adjustment and auxiliary modes.

The following requirements are placed on the VIK of the automated system for express analysis of potato quality:

OZU capacity not less than 160 decimal numbers;

processing time and printout of information for one consignment of not more than two minutes;

number of realizable subprograms not less than four (with a program dispatcher) at a level of introduced programs not less than six;

capability of operating in one of the indicated modes;

low cost and simplicity of maintenance.

A variant of the VIK based on the Elektronika TZ-16 computer, a block of BIP [expansion unknown] interface cards, a FS-1501 photographic reader, a PL-80 perforator, a Konsul-260 (254) typewriter and a digital signal switching block has been realized with regard to these requirements and analysis of tests of developed models.

Tests of the VIK in the experimental model of the ASEAK for potatoes, conducted in 1978 at the Chemerskiy Distillery, confirmed the correctness of selecting the technical solution established when developing the computer-information complex of an automated system for rapid analysis of raw material quality.
[1863/159-6521]

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CSO: 1863

UDC 658.5.011.56

APPROACH TO DETERMINING THE SAVING DUE TO FUNCTIONING OF ASU

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979
manuscript received 7 Dec 78 pp 35-39

[Article by Engineer B. V. Timon'kin]

[Text] Extensive introduction of ASU [Automated control system] into management of the economy and the related high expenditures for development and operation of them increased the requirements on the reliability of methods of evaluating the results of automation and specifically its economic effectiveness. The presently existing methods of determining effectiveness have a number of disadvantages caused by the following circumstances [1, 2].

1. The effect of ASU on production is accomplished indirectly through an increase of control quality rather than in the form of a direct effect. This causes an initially different scheme of analysis of ASU efficiency, which is study of the cause-effect relationship between changes in the management body (factors of the efficiency of the management level) and the changes caused by them in the control object and in interacting systems (factors of the efficiency of the controlled and related levels).

However, according to methods of [3, 4], analysis of the trends of formation of the economy begins directly with factors of the efficiency (FE) of the management body, as which the main trends of improvement of the production-economic activity are considered, which permits justification of the feasibility of ASU components, introduction of which is unrelated to any positive changes in the control sphere at all and thus cannot even be theoretically reflected in the functioning of the control object.

2. ASU and traditional administrative bodies still do not comprise organically whole systems. A significant part of the output documents of ASU is used only after correction, which frequently sharply reduces the quality of the optimum plans and solutions. In some cases the workers of VTs [Computer center] overload the executors with too detailed data which are difficult to analyze.

The advantages of automation of management are realized only partially in this case, which is reflected in the actual value of the saving.

3. Although the block method of construction and development of ASU is used in practice, the effect of individual problems on the components of the saving are weakly taken into account when determining the economic effectiveness [4], which makes it difficult to analyze the effectiveness of current development of systems.

4. The components of the saving are usually determined by the formula

$$\Theta = \alpha (\Phi_{ACY} - \Phi_0) \cdot O, \tag{1}$$

where α is a coefficient which establishes the fraction of ASU in variation of the corresponding index, F_{ASU} and F_0 are the value of the indicator before and after introduction of the ASU and O is the estimating or normative indicator.

This approach is feasible only on the assumption that there are absolutely no negative factors leading to reduction of index F. Otherwise a saving by its variation after introduction of the ASU cannot be assumed since this value will be clearly underexaggerated due to the addition of o posite vectors, which results in underestimation of the effect of automation of control on improvement of the indicators of the activity of the control object. But this hypothesis is unrealistic in the general case since many factors of different direction acting independently and separately of the ASU affects the results of production.

Moreover, methods of calculating the coefficients which take into account the effect of ASU on variation of the considered indices are not presented in the literature. They can be determined only on the basis of extensive use of methods of factor analysis and mathematical statistics based on processing a large amount of information over a period of years. The laboriousness and complexity of this work makes it unfulfillable for most organizations which introduce ASU and VT, which leads in practice to extensive use of the "expert analysis" method, by which the purely voluntaristic approach to determination and more accurately to selection of the indicated coefficients is frequently concealed.

The enumerated deficiencies considerably reduce the reliability of calculations of the design and specifically of the actual saving due to functioning of ASU.

The methodical approach to determination of the saving from functioning of ASU, developed with regard to the suggestions indicated in the literature [2], is considered below.

1. The saving from functioning of an ASU is determined in the profile of separate problems or complexes of interrelated problems.

2. Analysis of the factors of ASU efficiency begins with the first link in the mechanism of formation of the saving--the FE of the management level, at which the nonintersecting feasible changes in the administrative bodies are considered: acceleration of information processing, expansion of the information base, an increase of the accuracy of calculations, optimization of plans, reduction of the laboriousness of manual processing and so on.

3. The effect of the FE of the management level is measured by mean indices deterined by comparison to the corresponding parameter (volume of information, time of solution and entire function) of manual and machine documents received on the basis of the same input data. This comparison is made either at the stage of experimental introduction of ASU components or after beginning of their production operation. In the latter case, machine documents are compared to a duplicate document compiled manually by workers who are not interested in distorting the results of the manual version.

4. If it is impossible to estimate quantitatively the variation of one or another factor, the problem of its effectiveness must at least be solved qualitatively, using the alternative index of the "yes-no" type for this. In this case the scheme of investigation is inevitably simplified and is approximate in nature. However, even this analysis is very important since it permits determination and exclusion of problems from further consideration, automation of solution of which did not lead to improvement of control.

5. The use of the output information of ASU in executive documents and the completeness of realization of the latter are taken into account by means of a special coefficient.

6. Factors of the efficiency of the controlled and related levels are determined with regard to the essence of the problems and the FE of the management level existing for them.

7. For more detail, the FE are divided according to sources and if necessary according to items of saving. In this case sources of the saving are understood as potentially existing reserves or losses which can be realized due to the effect of factors of the efficiency of automation of control and items are understood as variation of the cost indices of the activity of organizations introducing ASU and the related economic objects (consumers of the product or services and so on).

The nature of the effect of the FE of the management level on factors of the following levels for problems with a functional dependence between the parameters of management decisions and the output indicators of the

work of economic objects (optimization and a number of information problems) is established by variation of the indicators considered in Section 3. In this case the saving for individual problems (complexes of problems) is determined by the formula

$$Э = П \cdot K_р \cdot K_т \cdot C_1 \cdot O, \qquad (2)$$

where P is the variation of the indicator which characterizes the effect of the FE of the management level, $K_т$ is the coefficient of realizing machine documents, Kp is the proportionality constant, C1 is the value of the indicator corresponding to the source of the saving after introduction of the ASU and O is the estimating indicator.

For the remaining problems, the saving is determined by the traditional method based on the principle of the "identity of the result." In this case the saving is determined by a formula of type

$$Э = \left(\frac{C_1^э}{Д_1} - \frac{C_0^э}{Д_0}\right) Д_1 \cdot O, \qquad (3)$$

where $C_0^э$ and $C_1^э$ are the value of the indicator corresponding to an item of saving, dependent on variation of the volume of work or services before and after introduction of the ASU, D_0 and D_1 is the volume of work or services carried out before and after introduction of the ASU and O is the estimating indicator.

Let us consider the use of the suggested approach on the example of estimating the saving on the problem "Formulation and processing of purchase-shipment documentation," solved in the ASU of Ukrglavlesbum [expansion unknown] of Gossnab of the Ukrainian SSR.

Automation of solution of this problem permits a sharp reduction of the laboriousness and time of document processing. Since the time expended on formulation of purchase-shipment documentation is a component of the time of circulation of funds participating in calculations for a supplied product, any reduction of the processing periods leads to a decrease of the circulating time by the same value. The latter makes it possible to free part of the borrowed circulating funds and because of this, on the one hand, to reduce the scope of the payment for Gosbank credits and, on the other hand, to bring the freed funds into economic circulation and to achieve a specific saving.

Analysis of the factors, sources and items of saving by the proposed scheme is shown in Table 1.

The meaning and values of the components of formulas (2) for the considered case are shown in Table 2.

Table 1. Factors, Sources and Items of Saving for the Considered Problem

Уровень образования экономии (1)	(2) Фактор	(3) Источник	(4) Статья
Управляющий (5)	Снижение трудоемкости обработки (6) Ускорение обработки (7)	Высвобождение работников управления (8)	Сокращение административно-управленческих расходов (9)
Управляющий (5)	Ускорение оборачиваемости оборотных средств в товарах отгруженных, но не оплаченных (10)	Сокращение среднегодового остатка заемных оборотных средств (11)	Экономия платы за кредиты банка (12)
Сопряженный (13)	Дополнительные финансовые ресурсы Госбанка (14)	Производительное использование дополнительных финансовых ресурсов Госбанка (15)	Дополнительная прибыль отраслей и ведомств (16)

Key:

1. Level of formation of saving
2. Factor
3. Source
4. Item
5. Management
6. Reduction of laboriousness of processing
7. Acceleration of processing
8. Release of management workers
9. Reduction of administrative-management expenses
10. Acceleration of the circulability of circulating funds in shipped goods, but not paid for
11. Reduction of the average annual surplus of borrowed circulating funds
12. Saving of payment for bank credits
13. Combined
14. Additional financial resources of Gosbank
15. Productive use of additional financial resources of Gosbank
16. Additional profits of sectors and agencies

The total annual saving according to the problem determined by formulas of type (2) based on the data of Table 2, comprises 55,700 rubles, including 5,600 rubles for reduction of administrative-management expenses, 5,000 rubles for reduction of payment for bank credits and 45,100 rubles for additional profits throughout sectors and agencies due to using the freed circulating funds.

The proposed approach takes into account the variation of the parameters of the control process due to the effect of ASU, the degree of realizing machine plans and solutions and the step by step nature of developing the systems. In cases when the saving is determined by formulas of type (2),

Table 2. Input Data for Calculation of Saving

(1) Показатель ФЭ управляющего уровня	Коэффициент реализации машинных документов (2)	(3) Коэффициент пропорциональности	(4) Показатель источника экономии	(5) Оценочный показатель
(6) Снижение трудоемкости ручной обработки одного документа — 0,033 чел.-дня	1	(7) Величина, обратная трудоемкости ручной обработки одного документа после внедрения АСУ — $\frac{1}{0{,}009 \text{ чел.-дня}}$	(8) Численность работников, занятых ручной обработкой документов после внедрения АСУ — 1 чел.	(9) Годовые расходы на содержание одного работника управления — 1,54 тыс. руб.
Сокращение продолжительности цикла обработки одного документа — 2 дня (10)	1	(11) Величина, обратная оборачиваемости ненормируемых оборотных средств после внедрения АСУ — $\frac{1}{8 \text{ дней}}$	(12) Среднегодовой остаток заемных оборотных средств после внедрения АСУ — 1003,2 тыс. руб.	Процент платы за кредиты банка — 2% (13) Средняя рентабельность оборотных средств [6] — 0,18 (14)

Key:

1. Index of FE of management level
2. Coefficient of realization of machine documents
3. Proportionality constant
4. Index of source of saving
5. Estimating index
6. Reduction of the laboriousness of manual processing of one document--0.033 man-day
7. Value inverse to the laboriousness of manual processing of a single document after introduction of the ASU--1/0.009 man-day
8. Number of workers involved in manual processing of documents after introduction of ASU--one person
9. Annual expenditures for support of one management worker--1,540 rubles
10. Reduction of length of the circulating cycle of one document--two days
11. Value inverse to the circulability of unnormalized circulating funds after introduction of the ASU--1/8 days
12. Average annual surplus of borrowed circulating funds after introduction of ASU--1,003,200 rubles
13. Percentage of payment for bank credits--2 percent
14. Average profitability of circulating funds [6]--0.18

the true fraction of the effect of the ASU on variation of the indices of activity of the controlled and combined objects can be estimated. This estimate cannot be made by using formulas of type (3), which have known

disadvantages, which are however partially overcome due to the fact that the saving is determined only by problems, automation of solution of which has a positive effect on the quality of control (see Section 4). Analysis of the effect of the FE of the management level for problems of ASUP [5] shows that a significant part of them does not improve the management process (with the exception of reducing labor expenditures) and, therefore, cannot ensure a saving. At the same time, the use of traditional methods also permits justification of their effectiveness in this case.

The considered approach is now the basis for calculation of the actual efficiency of ASU in organizations of Gossnab of the Ukrainian SSR, carried out at the PTO [Production and technical association] Ukrglavsnabsistema [expansion unknown].

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[1863/159-6521]

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CSO: 1863

UDC 65.012.45

METHOD OF DETERMINING THE VOLUMES OF INFORMATION OF ASUP PROBLEMS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979
manuscript received 6 May 79 pp 39-43

[Article by Candidate of Economic Sciences Yu. G. Krivonosov and Engineers N. M. Skopen' and A. V. Osadchuk]

[Text] A special role is given to determining the volumes of processed information affecting selection of the hardware complex (KTS) when designing ASUP [Automated Enterprise Management System] hardware.

A number of methods are now known which are oriented toward determining the volumes of recorded information [1], estimating the volumes of information at an enterprise [2] and so on. However, the given methods either require significant labor expenditures to investigate the management object or they did not permit rather simple determination of the information volumes corresonding to individual technological procedures of processing it (for example, input, sorting, processing and output).

The statistical method of determining the volumes of information of problems are the parameters of the management object using the ASUP of Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems] as an example is proposed below. The statistical relationship between the volumes of information and the parameters of the object was measured by means of multifactor correlation regression analysis on materials of 26 existing VTs [Computer centers]. Nine main subsystems of the ASUP [3], including the "Technical and economic planning" (TEP), "Operational management of basic production" (OUOP), "Management of material and technical supply" (UMTS), "Management of finances" (UF), "Management of the number of personnel" (UOK) and so on, was investigated.

Functioning and development of an enterprise can be characterized by the function of specific designation $f(X) = f(X_1, X_2, \ldots, X_n)$, which is an n-dimensional vector in the space of parameters of the object X_1, X_2, ..., X_n. The parameters of an object are understood as those economic parameters of the enterprise which reflect its production activity (for example, the total number of workers at the enterprise, the nomenclature of tools,

the nomenclature of materials and so on). The created ASUP reprocesses at a specific level of its development quite specific initial volumes of information on problems given by the parameters of the object. In turn, the volumes of information coming in for processing comprise the corresponding input information capacities W_j for the management subsystems. In this case the algorithm for solving any problem can be described by the model of conversion of a specific complex of object parameters. However, not all the object parameters (X_1-X_{210}) affect to a significant degree the volumes of problem information. Analysis shows that the information component (percentage in W_j) of combinations of parameters is low (up to one percent. This indicates the effect of one or another parameter of an object on the volumes of information.

It was established on the basis of the values of the information component of object parameters that 13 existing (basic) parameters of an enterprise are sufficient to determine the volumes of information. They include the total number of workers at the enterprise X_{15}, the total number of occupations for all sections X_{16}, the number of units of production equipment X_{17}, the nomenclature of produced products X_{40}, parts X_{43}, assembly units X_{48}, materials X_{60} and the nomenclature of complete sets of products X_{72}, the number of inventory numbers of basic funds X_{81}, suppliers X_{107}, freight consigne s X_{108} and so on. These are parameters which significantly affect the volume of information (the information component of which is more than one percent), are related to the class of independent parameters and may completely describe the information volumes of problems according to ASUP subsystems.

Calculation of the initial information capacity of the management subsystems, which is the preliminary information flow on problems of the corresponding subsystem which are processed under ASUP conditions, is the basis for determining the volumes of information. The initial information capacity is a complex parameter (integral criterion) for estimating the object parameters contained in the total. Moreover, its value takes into account such mean characteristics of parameters as the frequency of their use in the files and problems and the length of the files.

The general form of the model for calculating the initial information capacity is the following:

$$W_j = K_{W_j} (a_0 + \sum_i a_i X_{ji}), \tag{1}$$

where W_j is the average initial information capacity for the j-th management subsystem with one-time solution of problems, Kbytes, KW_j is the correcting coefficient which takes into account the absence of unessential parameters when estimating the value of W_j, a_0 is a free approximating coefficient, a^i is the approximating coefficient of the i-th basic parameter and X_{ji} is the quantitative characteristic of the i-th basic parameter for the j-th management subsystem (determined at a specific object).

The actual models used to calculate W_j are such functional subsystems as ASUP, TEP, OUOP, UMTS, UF and UOK are presented in Table 1.

Table 1. Information Capacity for ASUP Subsystems

Подсистема (1)	(2) Модель расчета W_j
ТЭП (3)	$1{,}038(217{,}1 + 0{,}72\,X_{60} + 0{,}02\,X_{68} + 0{,}3\,X_{69} + 0{,}03\,X_{66} + 0{,}04\,X_{72} + 0{,}1\,X_{81})$
ОУОП (4)	$1{,}063(0{,}27\,X_{17} + 0{,}07\,X_{68} + 0{,}042\,X_{66})$
УМТС (5)	$1{,}018(45{,}1 + 0{,}078\,X_{68} + 0{,}482\,X_{66} + 0{,}16\,X_{72})$
УФ (6)	$1{,}03(9{,}4 + 0{,}092\,X_{68} + 0{,}033\,X_{107} + 0{,}13\,X_{108})$
УОК (7)	$1{,}022(0{,}016X_{11} + 0{,}023X_{66})$

Key:

1. Subsystem
2. Model for calculation of W_j
3. TEP
4. OUOP
5. UMTS
6. UF
7. UOK

The values of the combined determination coefficients (0.98-0.99), the pair correlation coefficients of the basic parameters at W_j (0.52-0.99) and the normalized deviations of the approximating coefficients (not less than 2) found when constructing the models indicate the existence of selected values of X_{ji}. Moreover, the calculated values of the Fischer criterion is considerably higher than the critical values, which rejects the hypothesis "W_j is not dependence on X_{ji}" with probability of 0.95.

The object parameters directly affect the value of the following volumes of problem information: the volume of information entered $Q^{(1)}$ and sorted $Q^{(2)}$ in the computer, the volume of information $Q^{(3)}$ jointly processed in the computer, which is understood as the input of files in the external store of the computer or on punched carriers and output to the external store and also algorithmic processing of files, the volume of information $Q^{(4)}$ retrieved from the computer, the volume of intermediate calculations (formulated during problem solving) and the volume of normative and reference information $Q^{(5)}$.

The indicated volumes of information are calculated at TsNIITU [Central Scientific Research Institute of Packing Materials and Packaging] from materials of analyzing the statistical functions between W_j and Q and by the "average" problem of the management subsystem, which is understood as the problem, the volumes of information of which are the mean value of the corresponding volumes of the total problems of the planned ASUP. In this case the degree of complexity of problem solving, differentiation of problems to such conditional classes as planning, optimization, accounting and statistical and the main production procedures of information conversion in the ASUP (input, sorting, joint processing, output and storage) are taken into account.

The overall view of the model for determining the volumes of information by the "average" problem is

$$Q_j^{pk} = b_0 \pm b_j W_j, \qquad (2)$$

where Q_j^{pk} is the volume of information on the p-th production procedure with one-time solution of the k-th class of problems by the j-th management subsystem (Kbytes), b_0 is the free approximating coefficient and b_j is the approximating coefficient of the initial information capacity for the j-th management subsystem.

The actual models used for determination of Q_j^{pk} are presented in Table 2. The corresponding values of the approximating coefficients, the existence of which is confirmed by normalized deviation of W_j greater than two, are indicated in each specific model. The existence of the effect of W_j on the volumes of information is also confirmed by their sufficiently close correlation relation (0.53-0.94) and by satisfaction of Fischer's calculating criterion to critical conditions.

The information volumes of the preparation-input production pair reflects by its information nature the same aspect of the characteristics of the problem, i.e., one of them is essentially the information equivalent of the other. This is typical to some extent for such production pairs as output-multiplication and calculation of checked sums-preparation, which permits determination of their equivalents with acceptable accuracy by "Input" and "Output" procedures if necessary (see Table 2).

Table 2. Volumes of Information on "Average" ASUP Problem

(1) Подсистема АСУП	(2) Класс задач	(3) Модель определения объемов информации по технологическим процедурам ее преобразования. *Кбайт*				
		(4) Ввод $Q^{(1)}$	(5) Сортировка $Q^{(2)}$	(6) Обработка $Q^{(3)}$	(7) Вывод $Q^{(4)}$	(8) НСИ $Q^{(5)}$
ТЭП	Плановые (9)	0,012 W	0,122 W	5,37 W	1,486 W	555,9+0,707 W
	Оптимизационные (10)	0,007 W	0	38,95 W	0,013 W	0,167 W
ОУОП	Плановые	0,092 W	0,548 W	56,29 W	9,77 W	4,008 W
	Учетные (11)	0,023 W	0,14 W	11,062 W	0,711 W	2,19 W
УМТС	Плановые	30+0,008 W	0,036 W	3,068 W	0,404 W	0,194 W
	Учетные	0,002 W	0,053 W	2,94 W	0,129 W	0,27 W
УФ	Плановые	0	3,434 W	12,3 W	1,154 W	4,655 W
	Учетные	0,399 W	0	36,479 W	0,3+0,00009 W	6,009 W
УОК	Учетные	0,4+0,007 W	0,217 W	39,12 W	12,9+2,488 W	2,287 W

[Key on following page]

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Key:
1. ASUP subsystem
2. Class of problems
3. Model for determining the volumes of information according to production procedures of converting it, Kbytes
4. Input
5. Sorting
6. Processing
7. Output
8. NSI
9. Planned
10. Optimization
11. Calculated

The KTS of an ASUP can be selected on the annual interval of its loading, on the basis of the overall volumes of information on the complex of problems (total volumes of "average" problems) with regard to "intensive" (peak) time intervals (the periods when problems arrive with maximum volumes of information). Nonuniform loading of KTS is taken into account by the coefficient of the graph of nonuniform information loading $K_{g.n.z}$, whose value usually fluctuates in the range of 1.1-2.

The model for determining the total volumes of problem information (with the exception of volumes of intermediate calculations and NSI) will then have the following form:

$$Q_p = K_{r.s.s}\left\{\sum_j \sum_k \left\{\left[Q_i^{pk}(W_i)\right]\sum_i \Pi_{ji}^k\right\}\right\}, \qquad (3)$$

where Q_p is the total volume of the annual information load of the hardware for the p-th production procedure (input, sorting, joint processing and output) with regard to "intensive" intervals, Kbytes, and P_{jz}^k is the frequency of solving the z-th problem of k-th class for the j-th management subsystem, times/year.

Under conditions of modern ASUP, the information (files of intermediate calculations and NSI) is organized on the multifile principle (self-contained files oriented for specific problems) or in the form of a data base (reduction of separate problem files to a unified file) for a complex of problems. Individual files are used repeatedly when solving problems not only in some single ASUP subsystem but in problems of other subsystems. This is taken into account by coefficients of combining problem files of one subsystem ($K_{s.mj}^z$) and of different management subsystems ($K_{s.m}^p$). With regard to [3], their value will accordingly be equal to 0.2-0.7 and 0.28. The model for determining the volume of the data base ($Q_{b.d}$) will then have the following form:

$$Q_{0.a} = (1 - K^{a}_{c.u}\{\sum_{j}\sum_{k}(1 - K^{j}_{c.u/})\{[Q^{(5)k}_{j}(W_{j})]Z^{k}_{j}\}\} \text{ at } K^{a}_{c.u} < 1;$$
$$K^{j}_{c.u_{j}} < 1, \qquad (4)$$

where $Q^{(5)k}_{j}$ is the volume of files of intermediate calculations and NSI with one-time solution of the k-th class of problems by the j-th management subsystem (determined by Table 2) and z^{k}_{j} is the number of problems of k-th class for the j-th management subsystem.

The volume of self-contained files $Q_{a.m}$ with multifile organization of them is determined by (4) at $1 - K^{p}_{s.m} = 1$ and $1 - K^{z}_{s.mj} = 1$.

Models for determining the total information volumes (3) and (4) are synthetic multiterms in their content, which practically ensures the realization for any given set of problems and ASUP subsystems. The volumes of information obtained in this case permit selection of the required composition of equipment, since calculation of the amount of it is usually based on determination of the corresponding volume of information, the time permitted to process it, the productivity or speed (for external stores of certified capacity) and the utilization factor of the equipment. In this case the volumes of information and the technical parameters of the selected equipment should be reduced to a single-valued time interval (to one year in the considered case). The volumes of information determined by (3) are used when calculating the number of computers, its input-output devices and preparation and checking of data, and those determined by (4) are used when calculating the number of external computer stores for organization of information files.

The proposed method of determining the volumes of problem information of ASUP ensures selection of the required KTS, development of the technical assignment for the system, formulation of application data, analysis of the feasibility of developing individual VTs or of including an object in a time-sharing system as a user.

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[1863/159-6521]

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CSO: 1863

UDC 621.791-52

METHOD OF PROGRAM PREPARATION FOR INDUSTRIAL ROBOTS DURING ELECTRIC-ARC WELDING

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979 manuscript received 29 May 79 pp 51-53

[Article by Candidates of Technical Sciences V. I. Zagrebel'nyy and G. I. Sergatskiy and Engineers A. I. Bondarenko, A. S. Likhoshva and S. V. Dubovetskiy]

[Text] The industrial robot control program for automation of electric-arc welding contains information on the movement of the working member through the required trajectory (configuration control) and on the parameters of the welding conditions [1]. A method, the essence of which includes the following, was developed at the Institute of Electric-Arc Welding of the Ukrainian SSR Academy of Sciences for preparation of the program for controlling this robot.

Information on movement of the working member is received during training the robot by display of the extent of movement for each coordinate performed between reference points. The derived values of the coordinate displacements together with information on the parameters of the welding mode are recorded on the program sheet. This program is then punched on tape.

The main link in program preparation is the operator, whose work consists of three steps.

In the first step the process of robot training is accomplished to obtain information about movement of the working member. To do this, the operator carries out sequential movement of the working member from point to point along the connecting line. The control instructions for movement of the working member come from the control console. The control device is connected to the corresponding robot drive control channels by means of them. The extent of coordinate displacements between reference points are recorded in the OZU [Internal store] of the control device.

In the second step, after the working member has been joined to the next point of the given trajectory, the operator alternately switches the digital display board to the motion display device for each coordinate. The extent of displacements for each coordinate on the mixed interval is entered directly inpulses in the program sheet. Information for control of the corresponding production parameters of the welding mode, the preparatory and auxiliary operating functions of the ChPU [Numerical program control] system and the welding equipment carried out on a given interval is entered in the program sheet simultaneously. The training intervals usually correspond to the frames of the program, with the exception of those cases when the production operations are performed without movement.

In the third step, the operator punches the program carrier in the control device code by means of the corresponding program preparation devices. The finished punch tape is then entered in the program input device.

The given method is realized on an experimental model of an industrial robot for arc welding using the IES-690 five-coordinate manipulator [2] and the N55-1 UChPU control device. Since the robot operates in a spherical coordinate system, the interval between reference points is selected with regard to the the required accuracy of interpolation and maintenance of the given contour speed [3]. In this case the value of the interval should be an order less then the minimum value of the variable radius of the coordinate for extension of the robot's arm. The error resulting during program processing is then lower than the error introduced by the operator during positioning at the reference points (0.2-0.4 mm).

To realize the given method of program preparation by means of modern ChPU devices, it is sufficient to manufacture the simplest teaching console instead of an expensive teaching device. The significant increase of program preparation time by means of ChPU devices is compensated for by broad functional capabilities of the punch tape as a program carrier.

The length of the program recorded on the punch tape depends on the complexity of the welding line, the number of reference points and miscellaneous factors affecting the nature of the trajectory of the welding line rather than on the length of the process. The advantages of the punch tape should include the fact that the program prepared on punch tape provides for variation of the extent of movements and the number and nature of technological instructions. There is the possibility of entering a correction after welding of the first specimens, which is necessary during arc welding.

To check the operation of the control system in the multiple reproduction mode of an entire welding cycle, a jig to which two articles were attached simultaneously was manufactured.

A new instead of the finished article was installed after welding one article and return of the robot to the initial position for welding and the tape was rewound during this time. This permitted simulation of welding articles on a pulsating conveyor.

Thus, the given method of program preparation for industrial robots with punch-tape control permits preparation of the control program rather rapidly compared to the external programming method and with the accuracy required for production robots.

The use of the proposed method at enterprises on the basis of serial ChPU devices permits a reduction of the deadlines of introducing robots and effective sclution of the problem of automation of arc welding of articles of complex configuration.

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[1863/159-6521]

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CSO: 1863

UDC △ 62-237;621.873/.875

MICROPROGRAMMED CONTROL OF STACKING CRANES

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1979 pp 12-14

[Article by D. V. Anisimov and A. Yu. Verkutis, engineers]

[Text] Automated warehouses are widespread at the present time. Each line of such a warehouse consists of two rows of shelves with compartments for the storage of goods, between which a stacking crane of the shelf type moves over rails. The stacking crane is controlled automatically, either by a control computer or a special control device.

In recent time two-level hierarchic control systems have been used in automated warehouses where a large number of items are stored and they are intensively exchanged. Such systems are constructed on a centralized principle, in which the lower level is completely subordinated to the upper, or on a partially decentralized principle, in which the lower level has some freedom of action. On the upper level of the hierarchy a rather powerful high-speed electronic computer is used that coordinates the work of the following level. The use of several microcomputers is possible on the lower level.

Single-level control systems are used in small warehouses.

The stacking crane control system in an automated warehouse can be represented in the form of a block diagram (Figure 1), consisting of a control unit and an actuating element.

The control unit prepares an optimum program of action for the actuating element. According to signals from the control unit the stacking crane delivers goods to the unloading area or stores it in compartments of the warehouse.

The actuating element contains a controlling machine and a directly actuating element, the stacking crane.

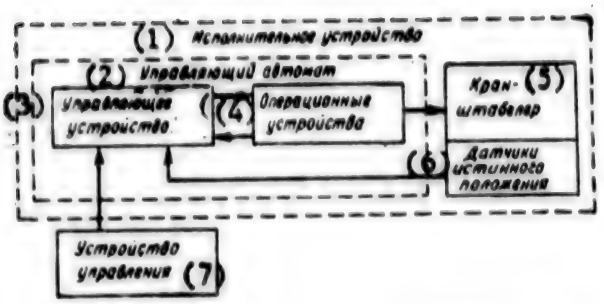

Fig 1. Block diagram of the control system.
1 -- Positioning element
2 -- Controlling machine
3 -- Control unit
4 -- Arithmetic unit
5 -- Stacking crane
6 -- True position sensor
7 -- Control unit

Orders are executed in the controlling machine on the basis of the principle of programmed control, in which the sequence in which operations are performed is determined by the program. Each program consists of operations and logical conditions which determine the sequence in tracing given operations.

Graph algorithm schemes and logical algorithm schemes are used to record microprograms of work of the controlling machine.

The actuating mechanism, the stacking crane, which performs operations in the delivery and stockpiling of a load in the shelf compartments, has two programs:

removal of the load from a certain compartment, its delivery to the unloading area and its subsequent unloading

stockpiling of the load from the loading position into the corresponding shelf compartment.

To analyze the work we will introduce designations of symbols for the initial, operator, conditional and final apices of the graph. The graph algorithm scheme for execution of the microprograms is shown on Figure 2, where $X = (x_1, \ldots, x_m)$ is the set of conditional apices and $Y = (y_1, \ldots, y_n)$ is the set of operator apices. The conditional apices have the values:

x_1 -- "start of program" -- the signal is introduced from the control panel by the stacking crane;

x_2 -- "correct input of program" -- the signal is prepared in the presence of the initial conditions and initial state of the mechanisms;

x_3 -- the program "remove load" -- is given from the control panel;

x_4 -- the program "place load" -- is given from the control panel;

x_5 -- "end of positioning" (pass along the coordinates X ("forward-back") and Y ("up-down") -- the signal is prepared at the end of positioning;

x_6 -- "load from compartment" -- the signal is prepared at the end of unloading the compartment.

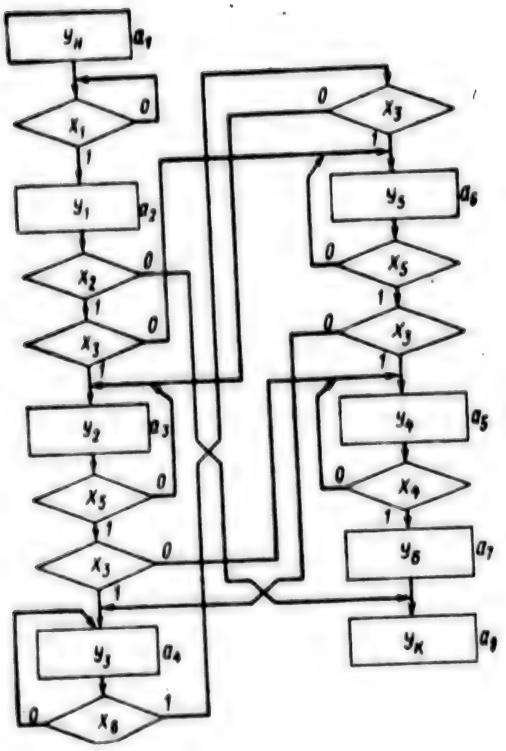

Fig 2. Graph algorithm of control scheme

The values of the operator apices are:

y_1 -- "verification of initial conditions" (the operational device verifies the initial conditions and initial states of the stacking crane mechanisms for subsequent execution of the microprograms, placement of the stacking crane platform in the center, the presence or absence of load on the platform, etc, and also verification of the program on the indicator);

y_2 -- "positioning in the prescribed compartment" (the operating equipment connects the address program and the feedback sensors corresponding to it on the coordinates X and Y to the device for formation of orders for movement of the stacking crane along those coordinates);

y_3 -- "control of the stacking crane platform during removal of the load from a shelf compartment";

y_4 -- "control of the stacking crane platform during loading of a compartment";

y_5 -- "positioning for the unloading position" (the operating equipment connects the code of the unloading position and the code of the sensors of true position of the stacking crane on the coordinates X and Y";

y_6 -- "end of program, indication" (necessary to verify the execution of the program and set the control unit in the initial position).

Let us examine the work of the controlling machine.

When the button "start of program" is pressed ($x_1 = 1$) with respect to the operator y_1 the operating device for verification of the initial conditions is switched on. Fulfilment of the initial conditions and the initial state of the stacking crane mechanisms ($x_2 = 1$) permits accomplishing the input of a program, and their absence ($x_2 = 0$) leads to return of the program to the start (shown on Figure 2 is the course toward y_k, which is equivalent to return to the initial state).

If then the program "remove load" is removed, the operator y_2 switches on the operating equipment for positioning on the X and Y coordinates of the given compartment. At the conclusion of the positioning--"the prescribed shelf compartment is found" ($x_5 = 1$) the operator y_3 controls the motion of the stacking crane platform; the entering of the compartment on the level below the lodgements; rise with the load to the level above the lodgements; the emergence of the loaded platform into the middle position. In the middle position upon conclusion of the action of the operator y_3 the signal $x_6 = 1$ is produced, according to which the operator y_5 switches the operating equipment for positioning to the unloading position. In that case on the indicator of the control panel appears the code of the unloading position and a transition to it is made on the X and Y coordinates. Upon the conclusion of positioning ($x_5 = 1$) the load must be removed. If the unloading position represents an ordinary shelf compartment, then that compartment must be loaded, that is, the platform must be introduced on the level above the lodgements, dropped to the level below the lodgements and emerge into the middle position. In that position ($x_4 = 1$) the operator y_6 verifies on the basis of the indicator the program signals and the signals from the sensors of position of the mechanisms of the stacking crane and sets the controlling machine in the initial position.

The work of the controlling machine, when introduction of the program "plac load" ($x_3 = 0$) from the control panel, can readily be traced in accordance with the graph algorithm scheme.

The logical algorithm scheme of execution of microprograms for possible computer programming is

$$y_n \downarrow_1 x_1 \uparrow^1 y_1 x_2 \uparrow^6 x_3 \uparrow^4 \downarrow_2 y_2 x_5 \uparrow^2 x_5 \uparrow^5 \downarrow_3 y_3 x_6 \uparrow^3 x_3 \uparrow^2 \downarrow_4 y_5 x_5 \uparrow^4 x_3 \times$$

$$\times \uparrow^3 \downarrow_5 y_4 x_4 \uparrow^5 y_6 \downarrow_6 y_k.$$

Synthesis of the controlling machine for realization of the stacking crane work program in according with the graph algorithm scheme is accomplished by:

a) selecting a model of a sequential machine (Mili or Mura);

b) obtaining the designated graph algorithm scheme;

c) construction of the machine graph.

It is most convenient of all to synthesise the logical circuit of the control unit on the basis of the structural table (see table) of a programming machine, representing a tabular recording of the machine graph in the form of a list of transitions.

a Исходное состояние	b Код исходного состояния	c Входной сигнал	d Последующее состояние (выходной сигнал)	e Код последующего состояния	f Функции возбуждения
a_1	000	$\bar{x}_1$	a_1 (—)	000	—
a_2	010	$\bar{x}_2$			k_2
a_7	100	1			k_1
a_1	000	x_1	a_3 (y_3)	010	I_3
a_2	010	x_2x_3	a_6 (y_6)	111	I_1, I_2
a_3	111	$\bar{x}_3$			—
a_4	011	$\bar{x}_2x_3$			I_1
a_5	111	x_2x_3	a_5 (y_5)	011	k_1
a_4	011	x_2			—
a_5	001	$\bar{x}_2x_3$			I_3
a_6	111	$\bar{x}_2x_3$	a_8 (y_8)	101	k_2
a_8	101	$\bar{x}_3$			—
a_8	001	x_2x_3			I_1
a_3	010	$x_2\bar{x}_3$	a_4 (y_4)	001	k_2, I_3
a_4	011	x_2x_3			k_3
a_5	001	$\bar{x}_2$			—
a_8	101	x_3	a_7 (y_7)	100	k_3

Key: a -- Initial state
b -- Initial state code
c -- Input signal
d -- Subsequent state (output signal)
e -- Subsequent state code
f -- Excitation functions

In the realization of the control unit on triggers I - k we have

$$I_1 = a_3x_2x_3 \vee a_4\bar{x}_2x_3 \vee a_6x_2x_3;$$
$$I_2 = a_6\bar{x}_2x_3 \vee a_1x_1;$$
$$I_3 = a_2x_2;$$
$$k_1 = a_7 \vee a_5x_2x_3;$$
$$k_2 = a_2x_2 \vee a_3\bar{x}_2 \vee a_5\bar{x}_2x_3 \vee a_4x_2x_3;$$
$$k_3 = a_5x_3.$$

Fig 3 presents a functional diagram of the control unit.

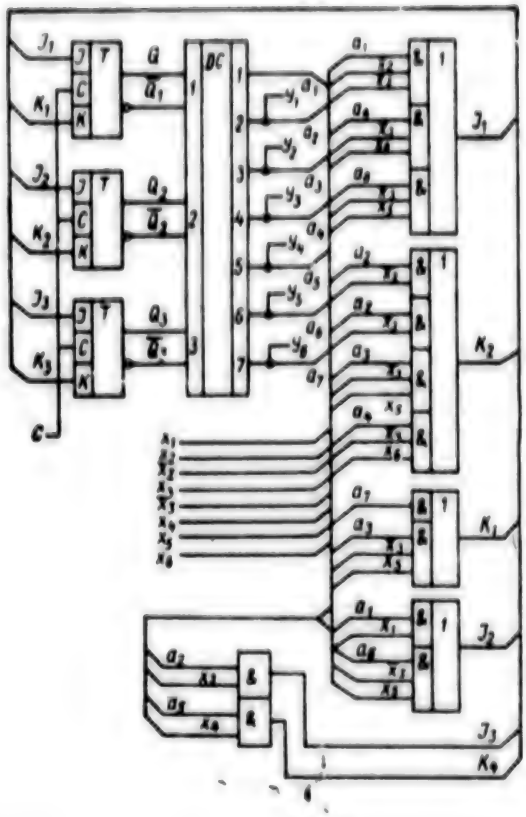

Fig 3. Functional diagram of a control unit.

[173-2174]

2174
CSO: 1863

UDC 002.5:65.011.56

DISTINCTIVE FEATURES OF THE AUTOMATION OF DATA PROCESSING IN THE STATEWIDE FUNCTIONAL CONTROL SYSTEMS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1979 pp 20-21

[Article by engineer B. N. Shokin]

[Excerpts] The improvement of data processing during the formation of information necessary for making efficient decisions on all levels of control is acquiring more and more importance. The urgency of the problem increases in connection with complication of the processes of social production and growth of the volume of information.

The statewide automated system for collection and processing of information for accounting, planning and control in the national economy (OGAS) now being created in our country, as is known [1], according to its functional purpose will include the following automated systems: for planning calculations (ASPR), for control of scientific-technical progress (ASUNT), for state statistics (ASGS), the automated information-controlling system for standardization and metrology (AIUSSM), etc.

In planning automated data processing in functional control systems on a statewide scale, along with the presence of a number of levels and links of control it is necessary to take the following distinctive features into consideration:

--the intersector character of the control system;

--the absence of a strict hierarchy, that is, of a clear administrative co-subordination of a number of levels of control.

As a rule, in the role of the controlling agency of a functional system on a statewide scale appears a state committee or an institutions analogous to it in the character of functions performed (the USSR Gosplan, the USSR Gossnab, the USSR Central Statistical Administration, the USSR Ministry of Foreign Trade, the State Committee for Foreign Economic Relations under the USSR Council of Ministers, etc).

In spite of the difference of the main tasks and the specifics of the functions of each state committee, they are unified by the coordinating, regulating and monitoring character of administrative activity, a distinctive

feature of which in the fulfilment of the main tasks (in contrast with the ministerial) is the accomplishment of intersectorial management not by subordinate agencies of control (ministries and departments), but also directly by enterprises and organizations.

Coordination on the scales of the state, accomplished by committees, is a form of administrative activity directed toward the regulation of only separate aspects of the work of ministries and departments and assuring unity of actions in certain directions of statewide importance. In all cases where the fulfilment of a given function or duty is not related to the exclusive competence of a committee, it can organize the work jointly with some other agency only on the basis of mutual agreement, that is, the form of unilateral prescriptions is excluded. Thus, among the functions not related to the exclusive competence of a state committee is the organization of an automated data processing system that includes elements of a system for processing the data of all functionally subordinate organizations.

As an example let us examine the activity of the USSR State Committee for Foreign Economic Relations (GKES), which fulfils the obligations of the Soviet Union with respect to economic and scientific-technical collaboration and the rendering of technical assistance in construction beyond the boundaries of enterprises and structures envisaged by intergovernmental agreements. About 90 percent of the total volume of work done by the GKES consists of deliveries of equipment and materials for foreign facilities. Participating in the process of planning and delivery of equipment and materials to facilities are over 80 ministries and departments that act as general suppliers, about 200 ministries that act as manufacturers, several thousand plants manufacturing export production. Numerous sales organizations of the USSR Gossnab participate in the process of deliveries to facilities. Reports on the course of deliveries arrive at the USSR Central Statistical Administration from all administrative levels.

As has already been said, distinctive features of the automation of data processing in statewide functional control systems are connected with the presence of many levels of control, the intersector character of the control system and the absence of a strict hierarchic co-subordination of levels in the control system.

On the example of the activity of the USSR State Committee for Foreign Economic Relations it can be concluded that the efficiency of functioning of automated data processing in a statewide intersector control system is determined not so much by the quality of the technology of data processing on each level of control as by the organization of foreign relations both vertically and horizontally. The introduction of automated data processing is prevented in that case by the following:

--the complexity of assuring information compatibility with numerous related automated control systems that have already been introduced on various levels and in data accumulation and processing blocks;

--difficulties in the introduction of standardized documents and standard procdsses of data processing in all links and levels of the interdepartmental control system;

--incomplete coincidence of the goals of a number of links of the system with the general goal of an automated system for the control of export deliveries of equipment and materials to foreign facilities.

The latter circumstance is especially important, as it can play a decisive role in the development and introduction of the automated processing system as a whole. Evaluation of the enumerated distinctive features in the automation of data processing in statewide functional control systems permits drawing the following conclusions:

1. The creation of an automated data processing system on the scale of any statewide control system under the conditions of the already formed local automated control systems of levels and links of control in practice cannot be realized by the collective efforts of specialists of all levels and links of control without efficient centralization of the process of its planning and introduction.

2. From developer organizations, on which the state committee places orders, is required the creation on the basis of the results of broad investigation of a unified process of data processing, maximally approximating the technical processes already introduced in the control links.

3. The introduction of a single technological data processing process can be successfully realized only on the basis of approximation of the goals of functioning of the entire controlling system and the controlling systems of levels and links.

4. The process of introduction of automatic data processing on the basis of a single technological process and operating documentation must be accomplished mainly by the forces of their developers on all levels and in all links of control of a functional statewide system.

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[173-2174]

2174
CSO: 1863

UDC 658.8 △ 621.7.08

EFFECTIVE YeS COMPUTER MONITORING OF THE FORMATION OF AN ORDER BACKLOG

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1979 pp 25-27

[Article by engineer S. V. Nefedov]

[Excerpts] The functional subsystem of an automated enterprise management system "Sales management" controls deliveries of finished product and assures the supplying of consumers in accordance with schedule-orders and the conditions of contracts.

The presence at enterprises of a large number of consumers, a large products list and numerous changes of orders creates considerable flows of information, on the timely processing of which depends the formation of a backlog of orders and fulfilment of the sales plan.

One of the tasks of the "Sales management" subsystem is "Current monitoring of the formation of a backlog of orders." Its purpose is to reveal discrepancies between the production plan and the order backlog of the enterprise, that is, to verify that the schedule-orders arriving for production correspond to the funds allocated in the plan of attachments.

The disk operating system of the Unified System (DOS YeS) represents several standard methods of organizing data into files and methods of processing them.

The method of sequential access assumes that the data are organized sequentially, that is, the recordings are arranged on an external carrier in the order in which they are processed. Files on all carriers--punched cards, punched tapes, magnetic tapes and magnetic disks--can have sequential organization. However, such organization of files has the following flaws: large data retrieval time, difficulty of introducing changes in them, etc. Many of those shortcomings are successfully avoided by using an external storage equipped with direct-access devices--magnetic disk stores with index-sequential organization of files.

The index-sequential method assumes an organization of the files similar to the sequential but at the same time permits direct access to recordings. Each recording has a key and in the creation of a file the recordings are arranged in the sequence of those keys. By using the indices it is possible to rapidly obtain access to individual recordings, and also to process the entire file sequentially.

The presence of direct-access devices in the YeS computer makes it possible to effectively organize the various and large-volume masses of information characteristic of automated production control systems with the production of numerous products.

The file principle has been made the basis for the creation of the information base of the task "Operative monitoring the formation of order backlongs." The files are subdivided into normative-reference, operative and intermediate (table). The normative-reference files such as "Production of the enterprise," "Consumers" and "Shareholders" are recorded on magnetic disks and organized index-sequentially. A standard approach has been developed for the creation and management of index-sequential files. A block diagram for the management of an index-sequential file is presented on Figure 3 (not reproduced).

A Файл	B Метод организации	C Используемый внешний носитель	D Длина записи в байтах	E Количество реквизитов в записи	F Назначение
1. "Продукция предприятия"	2 Индексно-последовательный	3 МД	160	17	4 НСИ
5. "Потребители"	Индексно-последовательный	МД	256	13	"
6. "Фондодержатели"	Индексно-последовательный	МД	40	3	"
7. "Прикрепления"	8 Последовательный	МД	80	12	9 Оперативная
10. "Наряд-заказы"	"	13 МД	120	18	"
"	"	МД	80	12	11 Промежуточная
12. "Сумма-1"	2 Индексно-последовательный	МД	64	8	"

Key:

A -- File
B -- Method of organization
C -- External carrier used
D -- Recording length, in bytes
E -- Number of requisites in recording
F -- Purpose
1 -- "Production of the enterprise"
2 -- Index-sequential
3 -- Magnetic disk
4 -- Normative-reference
5 -- "Consumers"
6 -- "Shareholders"
7 -- "Attachments"
8 -- Sequential
9 -- Operative
10 -- Schedule-orders
11 -- Intermediate
12 -- "Summa-1"
13 -- Magnetic tape

A sequential organization has been adopted for the operative files "Attachments" and "Schedule-orders". When there is a sufficient volume of disk storage the files are put on magnetic disks. However, for a number of enterprises a large volume of the "Schedule-orders" file is characteristic and it must be put on magnetic tapes.

Intermediate files are needed to obtain a number of task documents and are formed by the program, dispensing with any external means.

The composition and quantity of requisites of recordings of files were so selected in order to exclude duplication of information on the external carrier and the creation of files with small recordings. All the information relating to a given key link of the normative-reference information files, a consumer, product or shareholder, is introduced from the magnetic disk during a single reference to the recording with the given key, which greatly accelerates the solution of the whole task. In the file recordings a reserve is provided for that makes it possible to put additional requisites in them and use those files to solve other problems.

Forming the basis of the creation of the program complex for the problem "Operative monitoring of the formation of the order backlog" are the following:

1) three kinds of personal libraries on magnetic disks: absolute (BAM), objective (BOM) and initial (BIM) modules;

2) descriptions of all working files and their structures are placed in the BIM and connected to the program modules in the form of corresponding books;

3) all modules of the program complex are cataloged in the BOM;

4) operation of the complex in a multiprogram mode is possible on the basis of the created BAM;

5) the normative-reference files ("Production of the enterprise," "Consumers" and "Shareholders") are organized index-sequentially. The quantity and composition of the requisites in the recordings were selected in such a way as to exclude duplication of information on the external carrier and avoid the creation of files with small recordings;

6) a standard approach was used for the compilation of programs on the creation and management of files. Logical monitoring of introduced information was used in the management programs, and output forms with diagnostic reports on errors committed were developed;

7) the operative files "Attachments" and "Schedule-orders" were organized sequentially and as a functionn of the selection can be put on magnetic tape or disk;

8) displays are used to manage a number of files;

9) all types of input documents are formed automatically by one of the modules;

10) the apparatus of programs for sortout (from the DOS YeS software) is widely used.

The basic output documents of the complex are "Register of discrepancies of the production plan and the attachment plan" and "Register of divergencies of schedule-orders from the attachment plans" (Figure 4).

The obtaining of "Register of discrepancies of the production plan and the attachment plan" occurs as a result of processing product sorted out on the basis of increase if the number, and within each group by product, also on the basis of increase of the number of the shareholder of the "Attachments" file (the sorted-out file is "SORTOUT").

A production program is issued for each product, the remains from the start of the quarter, the total order, and the divergence of the reserve (the total of the remainder and the production program) from the order. Simultaneously with the formation of the register the file "Summa-1" is created, in the recording of which is included the size of the fund issued to the given shareholder with respect to the given product.

As schedule-orders arrive before the start of each planned quarter the "Register of divergences of schedule-orders from the attachment plans" is issued. The register is obtained by processing the sortout file "Schedule-orders." The sorting is done by fields: the number of the product, the number of the shareholder and the number of the consumer. The file "Summa-1" created earlier is used as an auxiliary.

The software of the complex is oriented toward the DOS YeS operating system. The algorithmic language PL/1 (version 2.1) was used for the programming. A standard minimal set of YeS computer peripherals is needed for operation of the program complex.

The task "Operative monitoring of the formation of the order backlog" is being carried out at the Tambovskoye "Pigment" Production Association within the complex of tasks "Sales management" with a YeS-1020 computer.

The use of the examined realization of the task is also possible at other enterprises where there is formation of a production fund, and not just in the chemical industry. When the programming complex for another enterprise is reorganized it is necessary to introduce changes and additions into the file base (if that is required) which take into consideration the specific [illegible] the enterprise. In addition, changes in the selection of external carriers for the disposition of masses of data and in the programs for their management are possible.

[173-2174]

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CSO: 1863

USSR

NUMBER OF ASU INTRODUCED FROM 1976 TO 1978

Moscow VESTNIK STATISTIKI in Russian No 11, 1979 pp 29-34

[Editorial Report] In an article discussing ways to improve the state system for measuring technical progress, reference is made to the 1162 new automated control systems introduced from 1976 to 1978. These include 595 automated industrial control systems, 218 automated enterprise control systems and 230 territorial automated control systems.
[168]

CSO: 1863-P

AUTOMATION IN AVIATION

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 2, 1980, pp 26-27

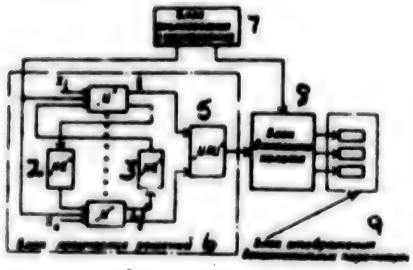
[Article by E. Meshkov, Colonel-engineer, Candidate in technical sciences, University lecturer; Yu. Sharov, Captain-engineer: "From film to computer."]

[Excerpts] Light ray systems for recording parameters (SRP) are currently being used in the capacity of means for objective control (SOK). However, along with their positive characteristics they have some shortcomings. For example, the limited number of recorded parameters, which lower the reliability and objectivity of quantitative analysis of individual flight schedules and thus of the missions as a whole, the absence of devices for automatic (computer) processing of the SOK records; because of which the time to decode the recorded information increases.

The effectiveness of the SRP significantly increases when decoding is fully or partially automated. The automation process primarily provides for the taking of the coordinates of the recording of the flight parameters from the tape of the information carrier and the transformation of them into electrical signals. Such signals can be further used in two variants. In the first, after the appropriate transformation they enter simulator-instruments or illuminated indicator boards which are set up in airplanes of the appropriate type. In this case all the records of the information devices are usually analyzed with the help of a model of the instrument board. This means of representing the information allows the crew to evaluate its work in a form they are familiar with and with the smallest expenditure of time.

In the second variant the electrical signals, again after an appropriate transformation, are input to a computer, which following a particular program, outputs the values of a given group of flight parameters which are not recorded in a clear form on the tape of the information carrier. This way of processing data makes it possible to expand the range of information (obtained) necessary for the analysis of the operation of a set of equipment, the actions of the crew in controlling the plane and raises the confidence level of the evaluation of the reliability of the functioning of the "man-machine" system.

The second variant of the system for processing flight information (as opposed to the first) additionally includes a multi-channel logical decision block made up of "AND," "NOT" and "OR" elements, a block for flight dynamics and a block for representing parameters not recorded on the information carrier. (Fig. 3)



Key:
1. AND
2. NOT
3. NOT
4. AND
5. OR
6. Logical Decision Block
7. Adjustment and Calibration Block
8. Flight Dynamics Block
9. Block for the Representation of additional Parameters

Figure 3. The system of means for the recording of flight information according to the second variant.

The circuit operates in the following way: electrical signals after leaving the adjustment and calibration block are sent to the flight dynamics block and the logical decision block with "AND" elements. At the same time these signals of X_1, X_k of the formation of the flight schedule are input to these same elements. These may be: signals proportional to the work of the motor in the "maximal," "afterburner" and other modes to variants of the load of the airplane, to angles of sweep of the wing. As a result on output from the "AND" elements, commands for reproducing flight schedules are generated.

The "NOT" and "OR" elements provide the properly sequenced transmission of these commands to the flight dynamics block. This block, on the basis of the functional relationships among parameters included in the mathematical model of the flight of the plane, and also of parameters recorded on the information carrier and the commands generated by the logical decision block, generates an additional group of parameters and sends them, in the form of electrical signals, to the block for depicting parameters not recorded on the information carrier and to the block for recording on the control map. Such parameters include: the angle of bank φ, the angle of attack α, the coefficient of carrying capacity S_y and many others, important in the analysis and evaluation of the safety of the flight, the results of the performance of the mission and the quality of the functioning of aviation technology during the flight.

The flight dynamics block for the complex can be an analogue block of domestic aviation training devices of the KTS type and the small scale analogue computers MN-7, MN-10, LMU, EMU and others. The issue of the possibility and efficacy of the reproduction of the additional parameters on digital computers, particularly the M6000, is worthy of attention.

Using a set of devices for processing the records of information it is possible to analyze the state of aviation technology and with great reliability to evaluate the technical possibilities of the whole set of equipment and actions of the crew in controlling planes, which improves their combat use.

The system may also be very useful in the analysis of preconditions of in-flight accidents, the establishment of schedules and flight paths when there is partial loss of flight information and also in the preparation and training of pilots in extreme flight conditions.

[203-9285]

9285
CSO: 1863

USSR

USE OF DIGITAL COMPUTER EQUIPMENT TO PERFORM THE FUNCTIONS OF RELAY PROTECTION

Moscow ELEKTRICHESTVO in Russian No 12, 1979 pp 6-11 manuscript received 21 Mar 79

BARABANOV, YU. A., Moscow

[Abstract] In the recent trend away from traditional electromechanical equipment for relay protection systems, more and more emphasis is being placed on semiconductor components and integrated circuitry, and attention is now being turned to the feasibility of using digital computers to perform relay protection functions. The author analyzes the general nature of jobs that can be handled by a computer system for purposes of relay protection, and evaluates the requirements to be met by the system. Two classes of problems are distinguished: monitoring the state of the facility to be protected as a whole, and localizing damage that has been detected. The control computers used to handle these jobs at present are mainly minicomputers, Soviet ASVT-M, M-6000 and M-400 machines, and non-Soviet PDP series, PDP-11. Many of the disadvantages inherent in centralized computer systems based on these machines can be overcome by using microprocessors, which are essentially programmable universal LSI chips. It is shown that a distributed system is optimum for utilizing the protective functions of the digital computer. The problems of developing software for such a system are discussed. Figures 3; references 5: 1 Russian, 4 Western.
[175-6610]

THE ROLLING MILL ROLLER IN THE SYSTEM OF EQUATIONS

Moscow TEKHNIKA I NAUKA In Russian No 11, 1979 pp 9-10

[Excerpts from an article by A. Ivanova, engineer]

[Excerpt] A comprehensive automated system of rolling mill control was required whose feedback system would permit correction of perturbations in the process as soon as they were detected and would also predict these perturbations ahead of time by allowing for the system's thermal inertia and thus eliminating it.

Resolution of this immense task was taken on by scientists and specialists at the USSR Academy of Sciences' Institute of Control Problems, the All-Union Scientific-Research Institute of Heavy Machine Construction at Uralmashzavod, Northwestern Polytechnic Institute, the All-Union Scientific-Research Institute of Metallurgical Machine Construction, the All-Union Scientific-Research and Planning Institute of Ferrous Metallurgical Purification, and the Cherepovets and Karaganda Metallurgical Combines.

In order to exert control, however, it is necessary to know the control object in all its subtleties. A model of the control object must be quietly and carefully studied in the quiet of the office. In order to examine such a model, we headed for the systems control theory and principles laboratory at the USSR Academy of Sciences' Institute of Control Problems, which is headed by professor Anatoliy Grigor'yevich Budkovskiy, doctor in technical sciences.

It took several months to assemble the sensors. In return, scientists had a terrific proving ground. Under actual conditions of production, in a real-time scale, over two dozen different rolling parameters were simultaneously recorded: thickness of sheet at the input into the machine and its output, rate of rolling, strip tension in each stand, degree of compression, rolling temperature and strip temperature at the output, temperature distribution along the rollers, flow rate of coolant water in each section and its initial temperature, temperature of waste coolant emulsion and likewise, through the sections along the rollers.

1. Computing Center of Cherepovets Metallurgical Combine.

Scientists collected so much unique data during the industrial experiment (30,000) that upon their return to the institute, it took the highest speed computer one year to process them.

Thus was born the first mathematical model of a rolling mill roller and the five-year stage of work was completed. The great team of scientists of different specializations and plant specialists set about to create an automated thermal profile control system for an operating roller. It is a system in which ideas will be used on prediction of the thermal state of the roller as a function of preset rolling conditions and technological parameters, and ideas on the use of feedback to maintain this state in a preset range, with on-line correction of deviations under error conditions to predict either unforeseen disturbances in the technological process or mechanisms of the rolling mill.

2. Processing Punch Cards at the Computer Center.

Work on creation of the new cold rolling milll control system, with prediction and maintenance of preset thermal roller profile, has been marked for introduction at the mill of the Karaganda Metallurgical Combine. It is hard to overstate the value of this system in rolling production.

It will operate like this. A built-in routine in the control computer starts to cool the middle portion of the roller. At specific time intervals, it begins sequential cooling towards the periphery of the remaining portions of the roller. The routine then maintains the thermal profile of the roller so that the strip has an identical shape and size along its entire width.

Measures have also been foreseen for the case where the rolling (billet entering the first mill stand) is, for example, thicker than is necessary in the middle part. Sections of the rollers situated over this thickened strip will heat up due to excessive loads and the routine will provide additional cooling there to compensate for this purpose.

This is where the feedback mechanism comes into operation. The rolling thickness sensors situated in this zone will send instructions to the hydraulic coupling to flex the roller in the opposite direction and increase the gap in between the rollers. If the rolling becomes even thicker, the hydraulic coupling must press on the roller neck with greater force and the bearings in which they rotate can not withstand this. The strain gauges in the bearings then give the alarm signal: "shut off the hydraulic couplings or we'll fall apart." The control computer quickly writes a new roller cooling routine based on accruing circumstances. Don't

forget that this all takes place much faster than you can read these words....

Only time, however, will tell if this prediction will correspond to reality.

[149-8617]

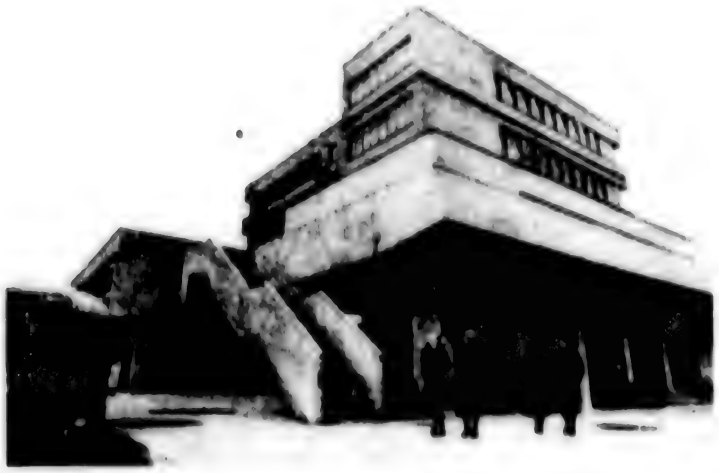
8617
CSO:1863

MINSK GROUP COMPUTING CENTER MOVES INTO NEW BUILDING

Minsk SOVETSKAYA BELORUSSIYA in Russian 12 Dec 79 p 2

[Photostory: "100,000 Operations a Second"]

[Text] The Gomel' Group Information-Computing Center of Avtotranssistema [Motor Vehicle Transportation System] Production Association has moved into new quarters. At their new building they are now at work on important economic problems of managing the work of the large motor vehicle transportation systems of the oblast. Minsk-32 and YeS-1022 computers that perform up to 100,000 operations a second have been installed in the spacious rooms. Taking the place of dozens of economists, the machines process goods-transport invoices and the trip logs of buses and trucks, analyze data on distance traveled and fuel used, and compute earnings for all categories of employees. The electronic brain finds and identifies the most economically advisable ways to use motor vehicle transportation in the oblast. (At right: In the machine room)



(The new home of the group information-computing center.)

[216-11176]

11,176
CSO: 1863

UDC 681.3:331.876.4

A SYSTEM FOR SUMMARIZING THE RESULTS OF THE SOCIALIST COMPETITION ON COMPUTERS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 1979 manuscript received 27 Mar 79 pp 1-3

[Article by Candidate of Technical Sciences V. A. Goncharov and Engineer N. I. Panin]

[Excerpts] A system for summarizing the results of the socialist competition of subdivisions (shops, departments, laboratories and plants) on the Minsk-32 computer has been developed and introduced at the Production Association Zhdanovtyazhmash [expansion unknown].

The software for the system was developed in COBOL language.

The annual saving achieved from introduction of the system comprises 16,000 rubles.
[1863/159-6521]

6521
CSO: 1863

UDC 331.875.4

EXPERIENCE IN THE USE OF AN AUTOMATED SYSTEM FOR MONITORING THE EXECUTION OF INSTRUCTIONS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1979 pp 18-19

[Article by V. L. Belousov, engineer, secretary of the Voroshilovskiy raykom (RK) CPSU, Moscow]

[Text] One of the important directions assuring increase of the effectiveness of control is improvement of verification that adopted decisions are carried out, including the search for and active introduction of the most advanced things created by science and affirmed by practice.

Study of the work experience of many industrial enterprises, scientific research institutes and state institutions on the improvement of systems for controlling and verifying execution shows that to assure better organization of control and the timely and precise execution of tasks, rulings and instructions of superior organizations and one's own decisions, electronic computers are finding ever-greater application. Because of the steadily growing volume of information, increase of the scales and the complexity of tasks being solved by Party organizations with respect to leadership of the collectives of enterprises and institutions an urgent need to use electronic computers also in the work of Party committees also has arisen.

In the Voroshilovskiy raykom of the Party of Moscow an automated system for monitoring the execution of adopted decisions of the CPSU RK on the basis of a complex of "Minsk-32" computers has been introduced. The system monitors the simultaneous execution of resolutions of CPSU RK plenums and offices, the plans, measures and other documents, the execution of which has been entrusted to primary organizations, the rayispolkom, Komsomol RK, the raykom of people's control and other social organizations.

The creation of the system was preceded by much work of the Party raykom; the necessary forms of monitoring were determined. In 1975 workers of the industrial transport section of the CPSU RK first started to use the system to monitor the execution of resolutions of CPSU RK plenums and offices in primary party organizations. Experience in operating the system in the

course of a year revealed its merits and shortcomings, and the further path of its improvement was determined on that basis.

Operation of the modernized system has confirmed the correctness and effectiveness of using electronic computers in organizing the monitoring and execution of party decisions.

The automated system for monitoring the execution of instructions of the Party raykom [ASKIP RK KPSS--avtomatizirovannaya sistema kontrolya ispolneniya poruchenly raykoma partii] is a complex, integrated, multi-level, standard referral system.

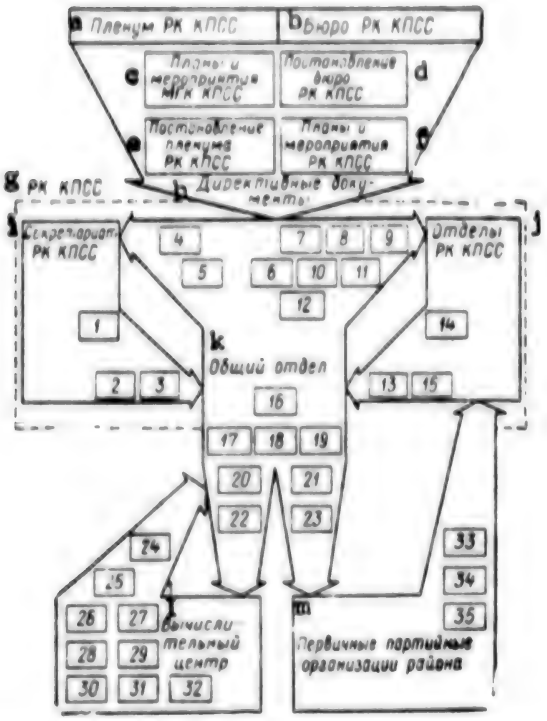
Presented in the figure is a functional diagram of the ASKIP RK KPSS. The system provides three hierarchic levels of Party raykom managers with the necessary information about the course of execution of CPSU RK instructions by a specific primary Party organization and for the rayon Party organization as a whole.

The first level is the secretariat of the Party raykom, which provides the organization with monitoring and verification of the execution of resolutions of CPSU RK plenums and offices and reports before CPSU RK plenums and offices on the fulfilment of resolutions. The secretariat does this work through sections of the Party raykom.

The second level is the heads of CPSU RK sections who monitor, each in his own direction, the course of execution of resolutions of CPSU RK plenums, offices, plans and measures and other documents considered in a section. The section heads make use of instructional personnel of the Party raykom in this work.

The third level is the CPSU RK instructors, whose duties include organization of the execution and rendering necessary help in the field to primary organizations in the execution of resolutions of CPSU RK plenums and offices (not only as a whole, but also by points), plans and measures of the CPSU RK, and also monitoring the dates of their fulfilment.

Actually, in the system for monitoring the execution of instructions two main functions are fulfilled by responsible workers of the Party raykom: monitoring and executive. In the automated systems the monitors are the instructors, section heads and Party raykom secretaries, and the executives are the responsible workers of the CPSU RK (instructors and Party raykom section heads), secretaries of primary Party organizations, chairmen of rayispolkom, the Komsomol RK and the raykom of people's control, directors of enterprises and institutions and other categories of managers on the rayon scale. The "input" into the system is a complex of all the resolutions, plans and measures arising in the process of the activity of the Party raykom. That information is entered on the printed form "List of Monitored CPSU RK Instructions" and then introduced into the system once, and then used multiply in it for the formation of all necessary print-outs.



Functional diagram of the ASKIP RK KPSS

a - CPSU RK plenum
b - CPSU RK office
c - Moscow gorkom plans and measures
d - Resolution of CPSU RK office
e - Resolution of CPSU RK plenum
f - CPSU RK plans and measures
g - CPSU RK
h - directive documents
i - CPSU RK secretariat
j - CPSU RK sections
k - General section
l - Computer center
m - Rayon primary Party organizations

1 - directive documents with resolution for execution
2 - reminder of CPSU RK with note regarding transfer of periods
3 - CPSU RK request
4 - report on the course of fulfilment of instructions by CPSU RK sections during ... months
5 - directive documents
6 - report on the course of fulfilment of instructions of the primary Party organizations
7 - monitoring plan for the month
8 - report on the course of fulfilment of instructions by sections during the month
9 - directive documents with resolution for execution
10 - report on the course of fulfilment of instructions
11 - report on the course of fulfilment of instructions of the group of primary Party organizations

12 - report on the course of fulfilment of resolution from ...
13 - list of monitored instructions of the CPSU RK
14 - reminder of CPSU RK with note regarding execution
15 - instruction of CPSU RK with note regarding execution
16 - reminder of CPSU RK with note regarding transfer of periods
17 - reminder of CPSU RK with note regarding execution
18 - instruction of CPSU RK with note regarding execution
19 - instruction of CPSU RK
20 - request of CPSU RK
21 - directive documents
22 - list of monitored instructions
23 - reminder
24 - instruction of CPSU RK
25 - reminder of CPSU RK
26 - monitoring plan for the month
27 - report on the course of fulfilment of instructions
28 - report on the course of fulfilment of instructions by section during the month
29 - report on the course of fulfilment of instructions by sections during the month
30 - report on the course of fulfilment of instructions of the primary Party organization
31 - report on the course of fulfilment of instructions of the group of primary Party organizations
32 - report on the course of fulfilment of resolutions from ...
33 - reminder of CPSU RK
34 - materials on fulfilled instructions
35 - instruction of CPSU RK

The state of execution of instructions is recorded in the form of nine print-outs (see the table) at each given moment of time. Then the read-outs are analyzed and an estimate made of the times and quality of execution by the monitors in the ASKIP, on the basis of the results of which a decision is made for the executives.

The system permits carrying out planned, systematic and preventive monitoring of the fulfilment of each instruction of the CPSU RK, the number of which does not exceed 12,000 per year. The volume of the information circulating in the automated system in the course of a year amounts to 26,148 documents or over 49,840 reports.

In practice the system can provide the monitoring of the execution of over 100,000 instructions.

Among the important merits of the system is simplicity of the forms or report read-outs, and the presence in them in uncoded form of all the requisites for execution of the instructions.

Item	Read-outs	Periodicity	Distribution
1.	CPSU RK instruction	Seven days after transmission of "List of Monitored CPSU RK Instructions"	Primary Party organization or executive in CPSU RK
2.	Reminder of CPSU RK	Weekly until instruction is completely executed	Ditto
3.	Report on the course of fulfilment of CPSU RK instructions	Weekly	Monitor in the CPSU RK
4.	Plan for monitoring CPSU RK instructions for ... months	Monthly	Ditto
5.	Report on the course of fulfilment of CPSU RK instructions for ... section	Ditto	CPSU RK section heads
6.	Report on the course of fulfilment of CPSU RK instructions by Party raykoms during ... months	Ditto	CPSU RK secretaries
7.	Report on the course of fulfilment of resolutions (designation according to formation) from ... (date)	Upon request	CPSU RK sections heads
8.	Report on the course of fulfilment of CPSU RK instructions by primary Party organization	Ditto	CPSU RK section heads and monitors
9.	Report on the course of fulfilment of CPSU RK instructions by a group of primary organizations	Ditto	CPSU RK section heads

Practically any document can be monitored by means of the ASKIP. Thus, along with monitoring the execution of the resolutions of plenums, offices and measures of the CPSU RK, the monitoring of definite instructions of the Party raykom secretaries, section heads and instructors can be accomplished. For example, by means of the ASKIP, monthly on set dates the CPSU RK can obtain operating data on the course of fulfilment of the technical and economic indicators by enterprises and organizations of the rayon, the fulfilment of socialist pledges by them, etc.

In addition, by skilfully using the possibilities of the system, a Party raykom assures monitoring the execution of a document so complex in composition and volume as the five-year plan for the social development of a rayon.

In the rayon certain experience in the use of ASKIP has been accumulated in the primary Party organizations. In 1974 upon the instructions of the CPSU RK at the First Moskovskiy Radio Parts Plant an automated system for monitoring the execution of instructions in the primary Party organization was developed and introduced. The application of the system is a real and effective means of monitoring adopted decisions, as is indicated, in particular, by this fact: starting in 1975 the plant party report and election meetings found that all decisions of the Party committee and the Party meetings were being fulfilled completely and in time. In spite of rather good results on the whole, work to improve the automated monitoring system continues. In 1977, with consideration of the acquired experience and the growing requirements for monitoring the execution of adopted decisions, at the plant a complex automated system for monitoring the execution of instructions of the Party and social organizations (the trade-union committee, the Komsomol committee and the main group of people's control) was created.

The ASKIP is a multi-purpose system for monitoring Party documents very different in character, composition and volume, with short and long periods for their execution. This makes it possible to also apply it in other rayon organizations--the rayispolkom, the rayon committee of people's control--and in the not-distant future, when economically justified--to expand its application in primary Party and social organizations, enterprises and institutions.

In connection with that questions arise regarding the operation of the ASKIP and learning the work of the apparatus in conditions of an automated monitoring system, etc.

In the rayon almost all the large Party organizations of enterprises and scientific institutions have an adequate technical base for the application of the ASKIP--many of them use electronic computers widely in the management of production or for scientific investigations. Consequently, operation of the ASKIP is assured by the corresponding computer centers. When the ASKIP was introduced along with other automated enterprise management

subsystems at the First Moskovskiy Radio Parts Plant no capital expenditures on the acquisition of necessary equipment and operation of the system were required even in the Party raykom. The problem was solved through the internal resources of one of the enterprises that had a computer center. However, that is a temporary solution, as it restrains further development of the system due to certain limitations on the use of machine time, difficulties in the creation of the technical complex for data transmission from the raykom to the computer center of the enterprise, etc. Therefore needed for a final solution of all these organizational and technical questions are rayon or city multiple-user computer centers, the task of which is to provide maintenance of the rayon or city automated control system of the rayon or city and also to perform agreed-upon computer calculations for enterprises and organizations not included in the sphere of rayon or city affairs.

In preparing for introduction of the system it is important to correctly organize the training of workers of the Party raykom apparatus and secretaries of primary organizations. In the Voroshilovskiy CPSU RK a special program has been prepared, one designed for several hours of classes; all responsible workers of the Party raykom without exception and the secretaries of primary Party organizations have undergone training in accordance with it.

The automated system for monitoring the execution of instructions does not require for its functioning special personnel or enlargement of the numbers in the Party raykom apparatus. It is designed for persons of practically any occupation and education, which is especially important for the rayon Party organization, where workers, engineering and technical personnel and scientists are elected to the management of the primary Party organizations. The ASKIP RK KPSS is a standard system and can be introduced without change in any Party gorkom or raykom, since the structure and functions of those Party apparatuses are similar, and the monitoring procedures are identical.

The introduction of the ASKIP in the Party raykom assured:

--automated monitoring of the fulfilment of instructions of the Party raykom;

--purposive coordination of the process of fulfilment of instructions;

--provisional release of the numbers of the Party raykom apparatus monitoring the execution of instructions, a higher level of quality control of execution being assured in that case;

--an indirect saving from fulfilment of all Party raykom instructions within the set times or ahead of schedule and completely;

--the preparation and issuance of necessary and reliable information on the entire list of monitored instructions.

The application of the ASKIP is reflected positively in the Party work in the rayon: there was a rise in the level of organization and efficiency of the apparatus of the Party raykom and the primary Party organizations, and such an important feature of the Leninist style of work as unity of word and action is realized.

Automated systems for monitoring the execution of Party decisions have not yet found wide enough application. However, the working principles built into them, the simplicity of systems and the possibility of rapidly teaching wide Party membership to use them and operating reliability create the necessary prerequisites for the introduction of the ASKIP into the working practice of local Party committees.

[173-2174]

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CSO: 1863

UDC 65.011.56.001.5

THE EFFECT OF CONDITIONS FOR DEVELOPING ASU ON EXPENDITURES RELATED TO THEIR DESIGN

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, 197- manuscript received 27 Nov 78 pp 32-35

[Article by Candidate of Economic Sciences I. I. Malikov and Engineer T. D. Denisova]

[Text] The process of developing an ASU [Automated control system] is frequently subject to random effects of both an external and internal nature.

Therefore, the investigation of this process during the design of an ASUP [Automated enterprise management system] must use probability models.

Methods of determining the main characteristics of the process of designing an ASUP as a queuing process and the results of modeling obtained by means of these methods are considered below. Let us assume that a Poisson flow of requirements with intensity λ of requirements per day, which can be calculated by the following formula, arrives at the input of the ASUP planning system:

$$\lambda = \frac{N}{365\, t_p},$$

where N is the number of problems solved in the system (number of programs) and t_r is the total planned ASU development time in years.

In this case the number of these requirements corresponds to the number of problems which it is planned to solve in the ASUP being designed. An algorithm and a program should be developed for each problem during design of the ASU, i.e., each requirement is serviced by a service channel (a designer).

The intensity of servicing the requirements by each channel of the servicing system (in the given case the ASUP design system) is calculated by the formula

$$\mu = \frac{1}{\bar{\tau}_p},$$

where $\bar{\tau}_r$ is the average laboriousness of developing a single program, man-days.

To select the optimum variant of servicing as the optimization criterion, let us use the minimum losses of the queueing system Z_p (rubles/day)

$$Z_n = C_1 \bar{v} + C_2 \bar{n}_{np} \to \min,$$

where C_1 is the price of waiting "in line" of one problem, rubles/day, C_2 is the average daily fees of the developer (with regard to overhead expenses), rubles, $\bar{v}$ is the average number of problems awaiting development per unit time and $\bar{n}_{pr}$ is the average number of developers involved in the design process.

The value of C_1 is logically determined as the fraction of the annual saving E from introduction of the entire system, calculated per problem per day,

$$C_1 = \frac{\Im}{365\,N}.$$

The given model was realized on the Nairi-2 digital computer. During the investigation, one part of the input parameters which characterized the developed automated system and the process of designing it (N, t_r, $\bar{\tau}_r$, C_1 and C_2) was fixed and the other part was variable. The values of $\bar{v}$ and $\bar{n}_{pr}$ are derivatives and are determined by analytical formulas of a multichannel Markov type queueing system as a function of the input parameters of the system λ and μ. The optimum number of developers n is determined by the criterion Z_p.

The main element which determines the preproduction expenditures related to creation of an ASUP is the number of developers. The model described above made it possible to study the effect of different conditions and factors on the optimum number of personnel.

Practice shows that all programs for solving problems on the computer may conditionally be divided into three classes as a function of the laboriousness of manufacturing them: simple, medium complexity and complex. Each of these classes is characterized by its own mean laboriousness of development. Approximate experimental data (on the order of 159, 228 and 394 man-days, respectively) were taken for the calculation. Making use of these data and assuming that there are developers of identical qualification in all cases, one can plot the dependence of their optimum numbers on

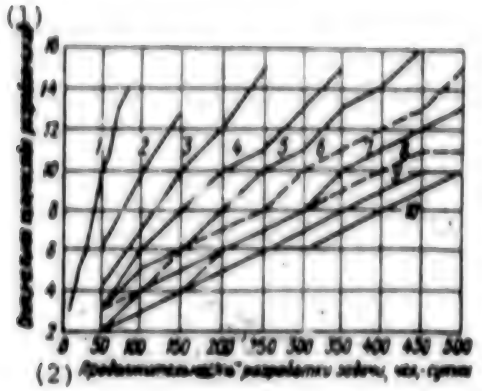

Figure 1. Effect of Complexity of Problems and Deadlines for Development of ASU on the Optimum Number of Developers

Key:
1. Optimum number of developers
2. Length of working out the problem, man-days

the complexity of the developed ASUP, conditionally characterized by the number of problems--programs in the system (Figure 2).

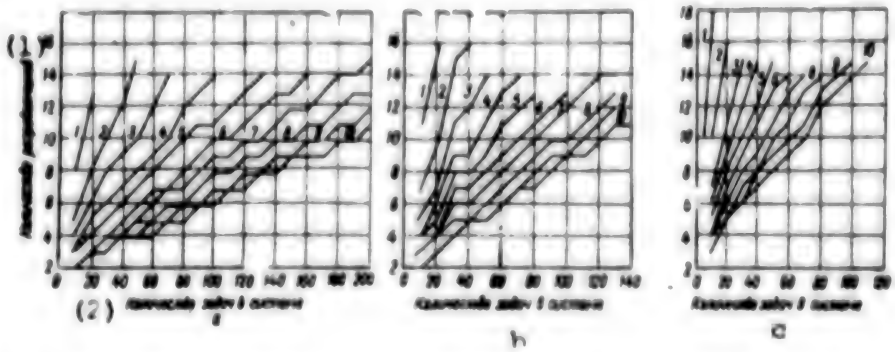

Figure 2. Effect of Number of Problems in the System and Deadlines for Its Development on Optimum Number of Developers at Different Level of Problem Complexity: a--simple problems; b--of medium complexity; c--complex problems

Key:
1. Number of developers
2. Number of problems in the system

Investigations showned that the number of developers increases approximately 2.15-fold with an increase of the laboriousness of the problems solved 2.5-fold (the optimum number for the three enumerated classes of complexity comprises 7.9 and 15 persons, respectively, for an ASU consisting of 50 problems and developed over a period of five years). It is typical that

the number of developers working out the program for solving simpler problems depends to a lesser extent on the total number of problems in the system than when solving complex problems.

The results of calculations also showed that some classes of ASUP with short directive deadlines cannot be solved within the framework of the considered ideal model. Thus, a system consisting of 100 complex problems can be designed within no less than nine years by 15 designers or within 10 years by 14 designers.

The given model of the process for development of an ASUP permits one to determine within which deadline a specific system can be developed with the presence of a specific collective of developers. The results of calculations shown in Figure 3 for different types of problems solved in the system permit one to determine the optimum deadline for development of the system with given number of developers. Calculations were carried out for a system with number of problems N on the order of 30 and an annual saving from introduction of it of approximately 300,000 rubles.

The investigations showed that the value of C_1 as a fraction of the annual saving from introduction of the designed system has an insignificant effect (at low values of ρ) on the optimum number of developers. However, this effect is more appreciable, the higher the value of ρ. Here ρ is the load of the system, determined by the ratio λ / μ. Thus, the greater the number of requirements coming into the system per unit time and going for one service requirement, the more service channels are required and the more appreciably the effect of the potential (calculated) saving of the developed system is.

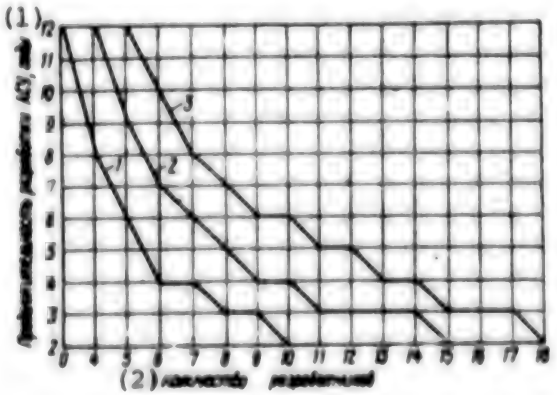

Figure 3. Dependence of the Length of Development of an ASU on the Number of Developers: 1--simple problems; 2--of medium complexity; 3--complex problems

Key:
1. Length of development of ASU, years
2. Number of developers

Investigation of the effect of rates for the optimum number of developers made it possible to establish that each dependence is essentially absent in the range of real average rates of the programmers. This indicates that the given factor may not be taken into account when predicting the number of developers.

The effect of the calculated efficiency of the designed ASUP (at low values of ρ) is also insignificant. Actually, cases with low values of are very real since less complex subsystems can always be separated from systems with a large number of problems during step by step development of them. This leads to a decrease of the intensity of problems coming in for development (λ) and consequently to a decrease of the value of ρ.

Breakdown of a complex system into independent blocks with fewer number of problems also permits a reduction of optimum losses (Z_p) during design by reducing the probability of the problems standing in line. If there is a given length of development of the system, the losses are less with a decrease of the number of problems. Losses during design are also reduced by increasing the given deadline for development. This result is explained by the fact that the minimized function Z_p indicates the total losses due to problems "standing in line" and due to the lack of occupation of the developers during "servicing" (both one and the other, as is known, occur as a result of random deviations which affect the queueing process). If the developments of the system secondary with an increase of the directive deadline are increased slightly, the former are reduced sharply since the cost of losses per unit requirement and the servicing channel are different. At the same time a total reduction of the minimum values of function Z_p with an increase of the deadline for development ceases to exist (due to the contradictory trends in both terms of the criterion of optimality and also due to the slowed tendency to reduce the number of requirements in the line).

An increase of the complexity of problems, like all the developed system, also leads to an increase of losses during development.

Investigations show that the described model of the process of designing the ASUP presents wide opportunities for determining the optimum quantitative conditions of design with regard to different circumstances.

The proposed method of calculating the main parameters can be used to model the process of designing ASUTP [Automated production process control system], ASDU [Automated dispatcher control system] and so on.
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SOVIET ADVANCES IN MACHINE TRANSLATION FEATURED

Moscow IZVESTIYA in Russian 9 Dec 79 p 6

[Article by A. Kondratov, candidate of philological sciences, member of the scientific council on cybernetics of the Academy of Sciences USSR, Leningrad: "The Computer Studies Three Languages"]

[Excerpt] The international seminar held in the USSR was a kind of summary of 25 years of searching in the area of machine translation. Scientists came to the seminar from the United States, France, Japan, East Germany, Poland, Czechoslovakia, Hungary, and Bulgaria. The Soviet contribution to machine translation was represented by Moscow, Leningrad, Kiev, Makhachkala, Minsk, Magadan, Chimkent, Kishinev, Alma-Ata, and Novosibirsk.

Soviet scientists are successfully developing translation programs for use from foreign languages into Russian. The main "translation shop" in the country today is the All-Union Translation Center (VTsP), whose annual output is more than 350 million words. Specialists of the center write computer programs that permit translation from three languages, English, German, and French. The center is also using "computer-assisted" translation where the human translator uses the resources of an automated dictionary to find words that are unfamiliar. Tests indicate that such a dictionary can speed up the work of a skilled translator 50-80 percent.

The "Speech Statistics" group, formed from research collectives at various higher educational institutions in the country, works closely with the VTsP. Scientists at Academy institutions are also engaged in work on the problem of machine translation. Among them are the Institute of Linguistics, the Computing Center of the Academy of Sciences USSR, and the Institute of Applied Mathematics imeni M. V. Keldysh.

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CSO: 1863

EC 1060 - SOVIET SYSTEM OF THE ESER (UNIFORM ELECTRONIC DATA PROCESSING SYSTEM) II

Berlin RECHENTECHNIK DATENVERARBEITUNG in German Nos 4, 5, 6, 1979

[Article by Dr. Werner Schulze, Academy of Sciences of the GDR]

[No. 4, 1979 pp 31-34]

[Text] On the occasion of the Leipzig Spring Fair 1978, the EDVA (Electronic Data Processing System) EC 1055, from the VEB Kombinat Robotron, was shown to the public as the first model of Series II of ESER. In the same year, several types of this series were presented, and finally the EDVA EC 1060. The EC 1060 model was already designed for Series I of ESER. While it was still in the development phase, it was converted into a model for Series II. This conversion was based on scientific-technical progress, especially in the component sector, and in production technology, as well as on the basis of experience from ESER I.

The EC 1060 is certainly the most powerful EDVA of ESER II. Installations of this type have already been produced and have also been exported from the Soviet Union since 1979.

The production enterprise of the EDVA EC 1060, the Minsk Production Association for Electronic Computing Technology (called MPOWT below), held a seminar from 26 to 30 November 1978, in which the model was presented.

The information provided in this seminar forms the basis of the series of articles on the EVDA EC 1060, which begins with the present paper.

1. Device Technology

1.1 Survey of the EDVA EC 1060.

The EDVA EC 1060 is a very productive universal computer, belonging to Series II of ESER and consequently to the third computer generation. Its association with Series II of ESER means that the development and construction of this model was based on advanced knowledge in the areas of computer

Processor and operating unit of the EC 1060

architecture and structure, systems software, component basis, and production technology. Outstanding characteristics of the EDVA EC 1060, which are proper to Series II of ESER, are the following:

- virtual storage with lateral organization and a total capacity of 16 M bytes
- universal instruction set of Series II of ESER with 183 instructions (instead of the 143 of Series I)
- possible capacity of working storage (real storage) of 8 M bytes
- high accuracy of floating point operation by processing 128 bit operands
- high reliability and availability through the possibility, which exists in the processor, for repeating the majority of instructions
- possibility for recording program events
- presence of an astronomical clock
- expanded aids for system control by the introduction of control registers
- expanded function of interrupt handling

Table 1 gives a survey of the essential application parameters of the EDVA EC 1060.

Table 1. Technical application parameters of the EC 1060

Capability	1...1.3 x 10^6 operations per second (Gibbson mix)
Capacity of working memory (real memory)	2...8 Mbytes
Number of block multiplex channels	3
Number of byte multiplex channels	1 with 4 selector subchannels
Multiprogram operation	with up to 15 programs
Power supply	3 phase AC 380/220 V, 50 Hz
Power consumption	80 kVA
Area requirement (depending on configuration)	200...250 m^2

The characteristics which have been listed, as well as the specified parameters, show that the EDVA EC 1060 has expanded functional capabilities, higher effectiveness, power, and reliability, as well as easier operation than the models of Series I of ESER.

One of the most important aids for reaching these objectives is the idea of virtual storage. This offers the programmer the possibility, with a real storage capacity of 2 to 8 Mbytes, of addressing up to 16 Mbytes with his program and of using expanding aids for controlling and using various operating modes.

The EVDA EC 1060 can be used in the operating modes

- multiprogram operation
- time sharing operation
- real time operation

as well as in multimachine complexes. The preconditions for this are not only the virtual storage concept but a developed interrupt system, aids for time calculation and storage protection, as well as an expansion of the list of system instructions, over and above those provided in Series I of ESER.

The basis for the high capability of the model 1060, as shown in Table 1, is formed by the following technical solutions:

- The use of rapid, highly integrated components (as logic circuits, ECL-circuits of the series 500 are used. The circuits are available in 26 modifications and are distinguished by electrical characteristic values with minimal delay times of 2 ms.)

- Utilization of a storage hierarchy with an effective addressing system that can be implemented in accord with the unit.

- Application of optimal algorithms for the execution of operations.

- Utilization of a special block for accelerating multiplication.

- Utilization of a flexible system of input/output channels with high throughput.

Special attention was paid to guaranteeing high reliability and availability of the system. This objective is served both by structural and design characteristics, both by hardware and software. For example:

Aids for determining errors in the hardware of the processor, in executing a series of instructions, and for automatic (up to eight times) repetition of these instructions in case of an error (after this, a machine error interrupt occurs).

Aids for determining errors and for automatic correction of single bit errors during write and read operations with working storage.

Aids for microdiagnostics of the system, by means of which device errors can be localized down to the plug-in unit.

The utilization of fast, highly integrated logic circuits, which achieves an increase of pattern density and a reduction of the number and length of cable connections.

(On the installation site, it was guaranteed that, despite the retention of air cooling, the required temperature regime may be maintained, but the space for movement required for maintenance and repair purposes is available.)

A modular construction principle with the following five hierarchical levels:

- integrated circuit
- plug-in unit for up to 60 integrated circuits with 135 pole multiple plug
- panels for up to 40 plug-in units with the corresponding electrical connections
- rack for up to 60 panels
- cabinet for one fixed and two pivoting racks

Utilization of advanced knowledge and corresponding production technology, characterized, among other things, by the use of multi-layer printed circuit cards for mounting the plug-in units, and the wiring for production of the panels, and ribbon cables for external connections between panels of one or several racks.

The developer estimates that the average error rate (mtbf) for the system, on the basis of the above and other measures, will be at least 200 hours. Practical confirmation of this claim is not yet available.

The basic configuration of the model EC 1060 comprises the devices summarized in Table 2. The device types will be described in the following sections, inasmuch as they are not yet known from previous publications. Anticipated further developments and solutions are given in Section 1.8.

Device Designation	Symbol
Processor	EC 2060
Working memory block	EC 3206
Universal multiplex channel	EC 4001
Control panel	EC 1501-01
Power supply	EC 0828
Control unit for interchangeable disk pack memory	EC 5566
Disk memory with interchangeable disk pack	EC 5066
Control unit for magnetic tape memory	EC 5525
Magnetic tape memory	EC 5025
Card reader	EC 6019
Card puncher	EC 7010
Paper tape reader	EC 6022
Paper tape puncher	EC 7022
Printer	EC 7032
Typewriter with control unit	EC 7077

Display screen group control unit with alpha-numeric display screens	EC 7906
Table top magnetic tape memory	EC 5009

(The table top magnetic tape memory EC 5099 is used to load the micro-program memory in the processor and in the control unit for the disk memory with interchangeable disk packs.)

Table 2. Basic configuration of the EC 1060

1.2 EC 2060 Processor and EC 0828 Power Supply

1.2.1 Survey

The EC 2060 processor is the central unit of the EDVA EC 1060. It organizes the processing procedure, controls the sequence of instruction execution, reactions to interrupts, the clock interval timer, and loads programs, initiates the operation of input and output units. The most important technical data of the processor are summarized in Table 3.

Instruction system	Universal instruction set of Series II of ESER
Control principle	Combined microprogram control and hardware control
Data width	64 bits
Control system	for parity, and according to the handling code, with read operations from working memory
Execution times for basic instructions (µs)	
Fixed point addition/subtraction	0.32
Fixed point multiplication	1.5
Floating point addition/subtraction	1.8
Load operations	0.32
Floating point multiplication binary	2.3
Fixed point division	5.75
Unconditional transfer	1.35
Writing into the memory	1.25
Protection code memory	
Capacity (words)	4096
Word length (bits)	8
Cycle time (ns)	60
Buffer memory	
Capacity (Kbytes)	8
Word length (bits)	72 (including 8 control bits)

Cycle time (ns)	60
Basis microprogram memory	
Capacity (bytes)	64
Word length (bits)	144
Cycle time (ns)	60
Microprogram memory	
Capacity (bytes)	1536
Word length (bits)	24
Cycle time (ns)	50
Number of plug-in units of the processor	570

Table 3. Technical data of the EC 2060 processor

A precondition for the high working speed of the processor is effective processing of instructions. This is done in two stages:

- Instructions are called from the buffer instruction register, and operand addresses are formed.
- Operands are called from the working memory or from the local memory.
- Operations are executed in respective blocks, and the results are entered into memory.

Corresponding to this tripartite division, the processor generally processes three instructions simultaneously on different levels. The levels work in time-synchronization. The working time on each level essentially takes two synchronization cycles (300...320 ns).

In parallel to the processing of instructions, the address of the following program portion is formed and this is read from memory into the buffer instruction register.

The basis of parallel instruction processing is the collaboration of the three function blocks central control (ZU), arithmetic block (BA) and storage control (UP).

The ZU block serves to call, decode, and buffer instructions, to call and process operands, to control the collaboration of the other blocks of the processor, and to execute system-internal functions.

The storage control secures the collaboration of channels and the central control with the working memory and the buffer memory, the conversion of virtual addresses into physical ones, information buffering for the channels

and the correction of single bit errors when information is taken over from the memory.

The arithmetic block executes arithmetic and logical operations with fixed point numbers, floating point numbers, and logical data. The numbers may be present both as binary and decimal numbers. Furthermore, operand addresses and running program addresses are formed in the arithmetic block.

In order to guarantee the high processor speed, the arithmetic block contains units for parallel information processing: a 64 digit parallel adder, a shift register, four information registers, and an eight digit adder for processing exponents and decimal numbers. To speed up multiplication, a block for high speed multiplication is connected as an auxiliary aid to the arithmetic block. It comprises 39 plug-in units, and it allows a reduction of multiplication time to 360...720 ns, depending on the length of the numbers being processed.

Besides the above-mentioned blocks, a control diagnostic block is also located in the processor. This block ascertains and localizes errors, repeats operations, and records events in the system. It causes the processor to change over into the diagnostic regime. The operator is connected with the system by means of a control desk, which provides control facilities and visual checks.

A fast buffer memory, based on integrated circuits, is used for the time coordination of the processor and the working memory. The working cycle of the buffer memory is equal to a processor cycle. This secures rapid preparation of instructions and operands. With a capacity of 8 Kbytes, about 95 percent of all storage calls are referred to the buffer memory.

One important characteristic of the EC 2060 processor is the fact that the central control and the arithmetic unit work under microprogram control, based on a microprogram memory which is built of integrated circuits. The microprograms are written into the control memory and they determine the sequence of processing steps and the processor cycles when executing instructions. They also determine the amount of overlap of the processing stages. They interrupt the processing sequence in the event of conflict situations, external conditions, and interrupt requests.

The microprograms in the basis block of the microprogram memory determine the specific activities that are required in executing instructions, or in interrupting and executing operations.

The application of microprogramming not only allows an overall reduction and simplificatation of the structure of control elements, but also makes the model more easy to repair. Furthermore, it gives the possibility of implementing a variety of changes in the instruction system, and makes possible a microdiagnostic regime, which can find and localize errors and faults.

1.2.2 The Design of the Virtual Memory

The virtual memory is an addressable memory with a capacity of 16 Mbytes. From the point of view of the user, it appears as a real memory of practically unlimited extent, i.e. programming is independent of the real capacity of the working memory.

The virtual memory is addressed by means of a logical address with a length of 24 bits. Physically, the virtual memory is implemented by a storage hierarchy. This consists of the working memory of the processor and peripheral mass storage media with random access. All data stored in the virtual memory are organized in segments and pages.

The peripheral memory and the working memory exchange data dynamically page by page. This process is controlled by the supervisor (component of the operating system, available beginning in 1979). The supervisor calls the virtual memory as soon as the execution of the program requires a new page which is not present in the working memory.

The program and its data can be transmitted between the working memory and the peripheral memory. In an instant, they can again be transferred into the working memory, when they are required for execution or when the processor attempts to call them. It is here not necessary to change or to check the program itself or its data. The program need not adhere to any special conventions, which concern program transfer. The sequence of program processing is not disturbed, except for a certain delay.

The logical addresses are dynamically converted into real addresses by means of re-addressing tables. The addresses referring to the page are subject to the same numerical conversion.

In order to simplify execution of input/output execution when using the virtual memory, the possibility of indirect addressing is provided for the data in the channel.

1.2.3 Auxiliary Means for Recording Program Events

The recording of program events is used to facilitate program tests. The processor contains auxiliary means for this, which make it possible to transfer to the test program information, in all cases where the following events occur:

- successful execution of a transfer
- change of the content of specified general registers
- call of an instruction from a given region of working memory
- change of the content of a specified region of working memory.

The situations which are regarded as events are determined by the program itself. It is optionally possible to prescribe one or more events which

are subject to being recorded. The information referring to the program event is made available to the program by means of a program interrupt. The cause of the interrupt is determined by the interrupt code.

1.2.4 Control System and Memory Protection Block

The control system of the EC 2060 processor is used for the comprenensive clarification of device defects and for increasing the reliability of the data being processed. The control system comprises technical auxiliary means referring to devices, microprograms, and programs. These means make available to the operator information concerning the location where a fault originates, its cause, and the status of the processor at the moment when a machine error occurred. In order to specify machine errors, an additional unit was introduced to form a code, in which a machine error leads to a logical error.

The control circuits are essentially designed to ascertain single bit errors and multi-bit parity errors. The main method used to check the data flows is the parity check. The following reactions to a machine error are provided in the processor:

- correction of single bit errors in the memory
- repetition of an erroneously executed microinstruction
- interrupt triggered by control circuits
- a stop caused by a control
- an attempt to continue working by ignoring the error.

The restart system is connected with the control system. It is used to eliminate the consequences of random machine errors. In the EC 2060 processor, the following units are used for restarting: the device restart, the microprogram restart, and the program restart.

A device restart takes place when a single bit error occurs in data that are read from working memory or from the control memory. The blocks for correcting errors in working memory and control memory execute the device restart. The correction of systematic, as well as of random, errors is here guaranteed.

A microprogram restart takes place by repeating microinstructions, at whose execution the machine error occurred, which is not a single bit memory error. If a repetition can be performed, the status of the central processor, which prevailed before execution of the erroneous microinstruction, is restored, and then a transfer is made to the erroneous microinstruction. The microprogram restart permits elimination of the effects of the majority of random errors during the normal course of program execution.

A program restart takes place with programs of the operating system, which are addressed during the course of an interrupt by the control circuits.

The interrupt code received from the control circuit is analyzed. The possibility of starting the interrupted program or the possibility of other actions is evaluated, if such other actions permit continuation of the program execution on the EDVA.

While information is being recorded by a device, it is transferred into the working memory. Such information can be prepared for analysis by the outputting personnel and can be outputted on a printer.

The memory protection block is used to protect certain portions of the working memory from erroneous calls during writing or reading. This block is used when several programs are being processed simultaneously, in order to prevent a program from accessing a memory region which belongs to another program.

1.2.5 Clock and Interval Timer

The clock in the processor is a binary clock with a double word format. It is used to calculate the running time, and is capable of specifying the date and the time of day. The clock is started by the operator. No event occurring in the system (except interruption of the processor power supply) will affect the clock, nor can any event stop the clock. The clock can also be set from the control panel.

The interval timer interrupts a program after a prescribed time interval has elapsed. It is used for the following purposes:

- calculating the time necessary to execute a job
- controlling constant program cycles
- setting of timer marks
- recording of time intervals.

The interval timer was implemented in the hardware and is a binary counter. The value of the timer is changed by reading out a one, after a certain time interval.

1.2.6 Adapter and Power Supply

The adapter for the operator console and the adapter for the console memory also belong to the processor. The former generates the signal sequences, which facilitate the work of the operator console in the operating modes read, write, and edit. The latter permits loading the control memory with microprograms that are read from the console memory. The control memory can be loaded automatically (when switching on the power supply) or manually (from the operator console).

The EC 2060 processor and the table top magnetic tape memory EC 5009 are supplied from the EC 0828 power supply unit. The unit is also used for central connection and disconnection of the power supply of the devices of

the EDVA EC 1060.

Power is supplied from a four-strand, three-phase AC network, with a blind grounded or insulated null conductor, a voltage of 380/220 V, and a frequency of 50 Hz. The power withdrawn from the mains is $\leq$ 24 kW with cosϕ $\leq$ 0.8.

[No 5, 1979, pp 33-35]

[Text] Beginning with No. 4, 1979, the Soviet computer system EC 1060 is presented in a three-part series of papers. The first part treated the hardware, and a detailed systems survey was given. The EC 2060 processor, the virtual memory, the memory protection block, the interval timer, and the power supply were discussed. The following paper concludes the hardware survey.

1.3 The EC 3206 Working Memory

The EC 3206 working memory unit has modular construction and consists of two autonomous blocks, each 512 Kbytes. They comprise not only the memory modules but also the local controls. Furthermore, a power supply is part of the EC 3206.

The storage modules are organized according to the 2.5D principle, and they consist of thermally stabilized ferrite cores with a diameter of 0.6 mm. The capacity of each storage module is 65 Kbytes, with a word length of eight bytes.

The processor and the memory blocks are connected through two exchange lines. The local control block receives the address signals and information codes from the processor, and transfers to it the data which are called as well as a repetition signal. The total working memory of the EDVA EC 1060 has a capacity of 2, 4, 6 or 8 Mbytes. A storage call can have multiple nestings of storage addresses, through four independent exchange lines. In this way, it is possible to reduce the call cycle for a storage block by a factor of four.

Table 1 summarizes the important technical data of the EC 3206 working storage unit.

1.4 The Channels

1.4.1 The Universal Multiplex Channel EC 4001

The EC 4001 channel is an autonomous input/output processor, which is connected to the central processor of the EDVA. The following belong to the channel:

Three block multiplex channels, which can work as selector channels, in dependence on the multiplex control bit. When executing an input/output operation, the channel, in the block multiplex regime, can be connected for another channel program, to execute a data transmission operation. The channel thoughput is 3 Mbytes per second, with two byte transmission, and 1.5 Mbytes with single byte transmission. Each block multiplex channel can service up to 256 addresses of input/output devices through 80 subchannels.

A byte multiplex channel with four selector channels and one multiplex subchannel. The number of subchannels in the multiplex subchannel is 256. The channel throughput of the sector channel is 500 Kbytes per second and that of the multiplex channel in multiplex operation is 100 Kbytes per second, and in burst mode is 200 Kbytes per second.

Control panel and power supply. The block multiplex channels are implemented by way of hardware, and the block multiplex channels use the microprogram control. The microprograms are inputted through the table top magnetic tape unit EC 5009.

Four new input/output instructions are additionally implemented in the EC 4001 channel:

- start input/output with fast switching
- enable input/output
- unit stop
- write channel identifier

The introduction of additional instructions expands the possibility of the channel working with dynamical address conversion. With this objective, auxiliary means for base addressing were included in the channel, as a supplement to the dynamical address conversion in the processsor. These auxiliary means permit data exchange to be controlled with one input/output instruction, without the use of chaining, where this data exchange does not involve different pages of the working memory.

Capacity (Kbytes)	1024
Access time (ns)	$\leq$ 650
Call width (byte)	16
Working cycle	displaced access
Power consumption (kVA)	$\leq$ 7
Number of working memory units EC 3206 per EDVA EC 1060	2 to 8

Table 1. Technical data of the working memory unit EC 3206

In order to increase the efficiency of system operations, the channels were equipped with the possibility of repeating instructions. The repetition of instructions is a function of the channel, which permits execution of instruction without triggering a request for an input/output interrupt. The existence of auxiliary means for expanded error recording in the channel makes it possible to maintain system operation by programming methods, when an error does occur.

The power consumption of the EC 4001 channel is about 8 kVA, and its weight is about 880 kg.

1.4.2 The Selector Channel EC 4035-03

The selector channel is used to organize data exchange between the working memory and the fast external memory in the burst mode of data transmission. The EC 4035-03 unit contains two selector channels. The EC 4035-03 constructively includes the channel-channel adapter EC 4060 (see Section 1.4.4). The EC 1060 model has the possibility of connecting up to three EC 4035-03 units. Table 2 contains the essential technical data for the EC 4035-03 channel.

Channel throughput, maximum (Mbytes/sec)	1.25
Number of input/output units addressable by one channel	up to 256
Number of peripheral control units that can be connected per channel	up to 10
Data path width when exchanging with peripheral units (byte)	1
Data path width when exchanging with working memory (bytes)	8
Power consumption (two selector channels and channel-channel adapter, kVA)	> 4
Weight (kg)	> 1200

Table 2. Technical data of the device unit EC 4035-03

1.4.3 The Multiplex Channel EC 4012-01

The multiplex channel is used by to organize data exchange between the working memory and the slow peripheral units (which can work in multiplex and burst mode), as well as between the working memory and the medium fast units (which operate in the burst mode). The essential technical data are summarized in Table 3.

1.4.4 The Channel-Channel Adapter EC 4060

The channel-channel adapter is used for data exchange between the input/

output channels of ESER models. The adapter can be used as a system aid for connecting several models into a multi-machine system. It then establishes a path for data transmission from one model to another, by using the channels of these models. When the adapter is used in a system with only one processor, data transmission is possible from one area of working memory to another area, by using the channels of the system.

Channel throughput, maximum (with two selector subchannels, Kbytes/s)	430
Number of input/output units addressable by the channel	up to 256
Number of multiplex subchannels	up to 224
Number of selector subchannels	up to 2
Number of peripheral control units that can be connected to one multiplex subchannel and to each selector subchannel	up to 10
Data path width when exchanging with peripheral units (bytes)	1
Data path width when exchanging with working memory (bytes)	8
Control system	parity control, on the hardware side
Diagnostic system	on the software side, with transfer of 24 bits into working memory
Power consumption	7
Weight (kg)	less than 1200

Table 3. Technical data of the multiplex channel EC 1042-01

The adapter connects together two channels. The maximum channel throughput is 1 Mbyte/sec.

Constructively, the unit is designed as a panel. The power supply blocks for furnishing the necessary voltages belong to that selector channel in which the adapter is constructively housed.

1.5 Disk Storage with Interchangeable Disk Packs EC 5066 and Associated Control Unit EC 5566

The disk storage with interchangeable disk packs EC 5066 is connected to the block multiplex channel of the EC 1060 model through its associated control unit EC 5566. The EC 5566 control unit is microprogram-controlled. In this way, the number of executable commands can be considerably enlarged, as compared to the disk storage control units that were previously used in ESER and the diagnostic possibilities can be expanded.

In order to increase the safety of the data being processed, a cyclical code is used in the device complex, which permits correction of reproduction errors. Furthermore, a regimen of command repetition is provided in the case of errors. The improvement of user parameters furthermore is facilitated by a diagnostic block, by means of which errors both in the hardware part of the control unit and in the interchangeable disk type memory itself can be ascertained and localized. The microprogram memory is designed as a semiconductive memory with a total capacity of 32 Kbytes.

The EC 5566 control unit has a two channel switch for usage in multicomputer systems (coupling through external memories). For connecting the EC 5066 disk memory with interchangeable disk packs to the control unit, one uses a special interface (small interface). This interface allows up to eight disk memories with interchangeable disk packs to be connected to one control unit.

The constructive and component basis of the EC 5566 control unit corresponds to that of the EC 2060 processor.

1.6 Magnetic Tape Storage EC 5025 and Magnetic Tape Storage Control Unit EC 5525

Both phase coding and the NRZI method are implemented in the magnetic tape storage unit EC 5025, as recording and reproducing methods. (In the first case, a recording density of 63 bit/mm is achieved, and in the second case, 32 bit/mm.) This fact permits users to transfer their magnetic tape data inventories, during normal operation, step-by-step to those tapes which use the more efficient method of phase coding.

The tapes of the magnetic tape storage unit EC 5025 are loaded semiautomatically. Furthermore, operating readiness is checked automatically. Table 4 summarizes the technical data of the magnetic tape storage unit EC 5025.

The magnetic tape storage control unit EC 5525 is a two-channel unit.

1.7 The Alphanumeric Display Screen System EC 7906

The EC 7096 system is a device complex for inputting and outputting alphanumeric data with control possibilities and editing possibilities. It is used to document the work performed with the models of ESER. It comprises a group control unit EC 7566. The EC 7066 comprises up to 15 alphanumeric displays, and a typewriter console 260.1.

The EC 7566 control unit works asynchronously with its own buffer memory. The capacity of the buffer memory contains the contents of four display screens. (When more than four units are connected, the number of characters that can be displayed per unit, independent of other units,

therefore falls.)

With the EC 7066 devices, one uses displays with a portable keyboard. These can be connected to the group control unit in four directions. The maximum distance for a single unit is 600 m, and for several units (in one direction) is 300 m.

Table 5 contains the technical data for the EC 7906 display system.

Tape speed in the working regimen (m/s)	2
Time for rewinding a standard reel (min)	less than 2
Recording density (bits/mm)	63 and 32
Recording method	phase coding and NRZI
Number of tracks	9
Transmission rate, maximum (Kbyte/s) with phase coding	126
With NRZI	64
Power consumption (kVA)	2

Table 4. Technical data for the magnetic tape unit EC 5025

Display EC 7066

Display screen diagonal (mm)	430
Dimensions of the working field (mm)	180 x 160
Number of lines	12 or 6
Number of characters per line	80 or 40
Number of characters (maximum)	60
Character dimensions (mm)	3.5 x 2.5 (in the format 80 x 12) 7 x 5 (in the format 40 x 6)
Character inventory (characters)	96
Image refresh frequency (Hz)	about 50

Total system

Average time between failures (hours)	$\leq$ 1000
Average time between errors (hours)	$\leq$ 100
Power consumption (kVA)	$\leq$ 2.5
Weight (control unit with four EC 7066 units; kg)	$\leq$ 570

Table 5. Technical data of the display screen system EC 7906

1.8 Further Developments Anticipated for the Hardware of the EC 1060 Model

In order to improve the user characteristics of the EC 1060 model, specific develoments of the hardware are anticipated. (Several steps will already be taken in 1979, and have already been considered in the preceding sections. Among these belong the utilization of transformerless power supply units, such as the EC 0828, the magnetic tape devices EC 5525/EC 5025, and the 100 Mbyte complex EC (5566/EC5066).

The focal point of further development, from the point of view of the user, is the anticipated substitution of the ferrite working memory EC 3206 by a semiconductor memory. The maximum possible real storage capacity of 8 Mbytes can then be housed in one cabinet (including its power supply). The semiconductive memory should be available beginning in 1981.

One measure which will be advantageous for operating the EC 1060 system, is the provided substitution of the loading unit for the microprogram control memory of the EC 2060 processor and the disk memory control unit EC 5566. The table top magnetic tape reader EC 5009, which is used at present, will be replaced by interchangeable semiconductor memories, beginning in 1980.

In the area of peripheral equipment, all newly developed peripheral devices for this model, which correspond to the user spectrum of the EC 1060 model, will be made available in the future. As a first and very important step, one should here mention the utilization of the display screen system EC 7920 (in place of the system EC 7906). This system should be available beginning in 1980. However, here too (as with the EC 7906), only a local area will be used at first. Nevertheless, the clearly superior user characteristics of the EC 7920 display screen system make it appear that its application will be very advantageous.

[No 6, 1979, pp 33-34]

[Text] The most essential elements of the new Soviet computer system EC 1060 are being presented in a three-part sequence of papers. The first part (4/1979) provided a survey of the hardware, of the 2060 processor, the virtual memory, the power supply, and the like. In the second part (5/1979), the working memory EC 2006, the channels (multiplex channel/selector channel), the disk memory and interchangeable disk packs EC 5066, the magnetic tape storage unit EC 5025, and the display screen system EC 7906 were explained. The third and concluding part treats the operating systems and the utility software, as well as use conditions and user opportunities.

2. Operating Systems and Utility Software of the EDVA EC 1060

The following machine-oriented software is furnished by the manufacturer of the EDVA EC 1060:

- the operating system
- a test monitor
- a complex of non-autonomous hardware tests.

The development and preparation of these software components were effected in collaboration between the manufacturer (MPOWT) and the Scientific Research Center for Electronic Computer Technology (NIZEWT). The application software has not been developed by these institutions, and consequently it is also not offered by the manufacturer.

2.1 Operating Systems

The operating system for the EDVA EC 1060 was developed within the framework of collaboration of the states participating in ESER. The work was divided between the NIZEWT and the Center for Research and Technology of the VEB Kombinat Robotron. The operating systems for the EDVA EC 1060 and EC 1055 are identical. For this reason, only a few general statements will here be made concerning this complex. For details, especially for explanation of their content, reference is made to the respective bulletins and publications of the VEB Kombinat Robotron, some of which are in preparation, which are connected with the EDVA EC 1055.

At the present time, the EDVA EC 1060 is delivered with the OS/ES 4.1 operating system. This involves the most highly developed operating system of Series I of ESER. Accordingly, it does not support the new system possibilities of Series II (in particular, work with the virtual memory is not possible). Neither does it use the functional extension of Series II. The operating system OS/ES 4.1 consequently represents only a transitional solution for the EDVA EC 1060 (as also for the EDVA EC 1055). In 1979, it will be replaced by the first version of the OS/ES 6 operating system, namely the version OS/ES 6.0. The OS/ES 6.0 operating system corresponds to the contingencies of Series II of ESER. Its versions will make available to the user, step-by-step, the hardware capabilities of this series. Already in 1980, the OS/ES 6.0 version will be replaced by the OS/ES 6.1 version.

(The OS/ES 6 operating system can work not only with 100 Mbyte disks but also with 29 and 7.25 Mbyte disks. But then it requires not two units but three or respectively four units.)

2.2 Test Monitor

The test monitor system is used for the aperiodic or periodic testing of the functional capability of the reliability of the EDVA EC 1060, as well

as to ascertain and localize errors in utilizing this system. With this objective, the following specific tests can be performed:

- running through the test monitor
- testing the interchangeability of magnetic disk memory packs
- testing the interchangeability of magnetic tape memories
- monitoring the time of the working capability of the system
- testing the auxiliary means for direct control

The system comprises the following programs:

- basis test
- control program
- program for operating the test tape
- test programs (test sections)

The programs are stored on magnetic tape in the sequence specified. (The use of punched cards as a program data medium is also permitted.) The basis test, the control program, and the program for operating the test tape are self-loading. The basis test and the program for operating the test tape are independent programs. The test sections can work only under the control program.

The basis test tests the correct execution of the programs used by the control program, the effectiveness of the interrupt switch, as well as the operational capability of the operator typewriter and of the magnetic tape unit on which the test tape is mounted.

The control program controls the work of the test sections. It uses tables with information concerning the configuration of the specific EDVA, the capacity of the working memory, and other specific features of the system. These tables are also used by the test sections, and they must be adapted to configuration changes.

2.3 Complex Non-autonomous Device Tests

The complex non-autonomous device test is used to test input and output units under the control of the OS/ES 6 operating system. It makes it possible to diagnose input and output errors and to test maintenance and repair measures, as well as to test for technical changes. Furthermore, it can be used for periodic hardware testing.

The complex of non-autonomous tests consists of a control program and of the tests themselves (programs for checking the input and output units). It is put into effect during the system generation, in the specific variant of the operating system, and it is made part of the system library. The tests are usually furnished on magnetic tape as object modules. By means of program linkage, they are transferred to that library which is not used during the autonomous tests.

Working temperature	+ 14° C...+ 20° C
Relative humidity	75 percent
Ventilation	forced ventilation from below
Grounding	radiation grounding
Freedom from dust for particle sizes $\leq$ 3 µm (for 100 Mbyte disk storage)	up to 0.3 mg/m^3

Table 1. Installation conditions for the EC 1060

A special storage region is required for executing non-autonomous tests. Before the beginning of testing, all the devices being tested must be withdrawn from the operating system's access. They must for this purpose be put into off-line status. The operator of the EDVA can use operator commands of the usual form, to request, through the channels, the execution of the necessary tests for desired units. The tests can be terminated at arbitrary times, or new tests can be demanded. The operator can request the performance of several tests at the same time or the testing of more than one unit. (In the latter case, the units must all be of the same type. These will be tested sequentially and not in parallel.)

The complex of non-autonomous tests permits operation in the multiprogram mode, i.e. the tests can be executed in parallel to other jobs and influence execution of the jobs only minimally. For system configurations with a large assortment of input and output devices, this mode of procedure can become an important operating aid.

At the present time, all peripheral devices which belong to the system inventory (see Section 1 of No. 4/1979, p. 31), have tests available, or such tests are in preparation. The complex of non-autonomous tests is a system that is open for expansion; accordingly as new peripheral units of ESER are developed, and as they are supported in the operating system of the EDVA EC 1060, new tests can be worked out and can be connected.

3. Use Conditions

3.1 Installation Conditions

Detailed conditions and requirements exist for installing the EDVA EC 1060. The most important parameters are collected together in Table 1. The required environmental conditions necessitate the use of air conditioned rooms. The machine rooms must have a double floor, with a load capacity of 800 kg/m^2. (Depending on the configuration to be installed, the area will vary between 200 and 250 m^2. If semiconductor working memories are used, a noticeable reduction can be achieved for large configurations.)

The manufacturer does not require a motor generator set but a decision on this questions should be made depending on the respective circumstances of the mains power supply.

4. Application Possibilities of the EDVA EC 1060

The starting point for considerations on the application opportunities and use areas of the model EC 1060 is the fact, already mentioned initially, that this system involves the most powerful model to date of ESER. (The nominal capability of the processor approximately corresponds to those of Type BESM 6. With the EC 1060 model, however, significantly greater accuracy of information representation and more favorable use characteristics are offered.)

The hardware and software possibilities of the EDVA EC 1060 provide the preconditions for its use to solve a large group of scientific-technical, economic, and information problems. At the present time, the remote processing components (hardware as well as software) are developed only poorly. After they have reached their anticipated status, remote batch processing and time sharing operation can be realized with this model. In the more distant future, the EDVA EC 1060 can be integrated as the working computer in interlinked systems. This offers the opportunity of significant progress on the part of applications systems. (In the same sense, the stable large-area storage technology for direct access, and the system of corresponding software now offer opportunities for extensive data bank utilization, which is connected with the utilization of data banks in the conversational mode.)

For the GDR, it can first of all be stated that the EC 1060 model is of interest from several perspectives. It can, for example, be used to replace the present EDVA BESM 6, if such a replacement should take place, on the one hand, without significantly expanding the capability of the respective computer center, and, on the other hand, cannot be attained by the model EC 1055 from the VEB Kombinat Robotron. Furthermore, the EDVA EC 1060, in its subsequent developmental stages, is significant for large scale users of electronic computer technology with qualitatively heightened requirements for information processing, if these requirements exceed the capabilities of other ESER models.
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SELECTIVE LIST OF JPRS SERIAL REPORTS

USSR SERIAL REPORTS (GENERAL)

USSR REPORT: Agriculture
USSR REPORT: Economic Affairs
USSR REPORT: Construction and Equipment
USSR REPORT: Military Affairs
USSR REPORT: Political and Sociological Affairs
USSR REPORT: Energy
USSR REPORT: International Economic Relations
USSR REPORT: Consumer Goods and Domestic Trade
USSR REPORT: Human Resources
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